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NURSES HANDBOOK
OF
DRUGS AND SOLUTIONS

STIMSON



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NURSES HANDBOOK OF DRUGS AND SOLUTIONS

By JULIA C. STIMSON, R.N.

III

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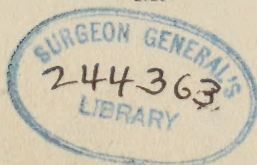
*Superintendent of Army Nurse Corps and
Dean of Army School of Nursing
United States Army*



THIRD EDITION

WHITCOMB & BARROWS
HUNTINGTON CHAMBERS, BOSTON

1920



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PREFACE TO FIRST EDITION

THIS book has two objects: first, to present as much *Materia Medica*, in a simple and useful form, as is essential for a nurse to know; and second, to omit as far as possible all that is not essential, albeit interesting and useful. It is not a reference book, but if mastered as a text-book it is hoped that the information it contains will enable nurses to have a sense of security and familiarity in the handling of drugs that will be of use and satisfaction to them in the practice of their profession, and also, that by its aid they will have no difficulty in preparing themselves for their examinations on the subject for State Registration.

It is recognized that the Practical Classification is open to criticism as illogical and arbitrary. But it has not been made without reason. A study of many text-books of *Materia Medica* for medical students and those for nurses has shown the great variety and the complexity of the classifications of drugs as therein presented. Some authors believe that it is impossible properly to classify drugs according to their action, as the majority of drugs have several equally important actions; therefore, they arrange the drugs alphabetically. Some classify according to the physiological action; some according to the therapeutic uses. The last arrangement is accepted by most writers as the best method. It is, however, a somewhat complicated and much subdivided method. The arrangement in these pages has worked itself out from a series of lessons based on the most common and important drugs which are administered by nurses in the wards of large general hospitals. They fall into groups classified according to their importance and therapeutic action. It is, of

course, as impossible to draw a line between the essential and the non-essential as it is to make a list of drugs arranged in sequence according to their power and importance. Such things are a matter of opinion and somewhat of locality. But a practical, easily memorized arrangement should be tried.

A nurse's use of *Materia Medica* is limited, and lies along different lines from the uses to which a doctor applies his knowledge of the subject, as it is beyond her province ever to prescribe. Still, it is essential that a knowledge of the powerful and important drugs be a part of her working equipment, that she may be able to afford the intelligent assistance to the physician, on behalf of the patient, that is required of her.

To make such a knowledge an easy acquirement, this book has been prepared for use as a practical handbook, as well as a classroom manual.

PREFACE TO REVISED EDITION

IN order to eliminate all drugs which are no longer commonly used, and to add such new preparations as have been brought into use since this book was written in 1911, it has been thoroughly revised by Dennis E. Jackson, M.D., Ph.D., Associate in Pharmacology of Washington University Medical School, St. Louis, Mo.

J. C. S.

St. Louis, 1915.

PREFACE TO THIRD EDITION

To bring the book again up to date, it has been carefully revised by Philip M. Stimson, M.D., Clinical Instructor in Pediatrics, Cornell University; Assistant Attending Physician, Willard Parker Hospital, New York, who has made a number of valuable additions and alterations. The Metric

System, Common Thermometric Scales, and the Harrison Narcotic Law, for instance, have been added.

In the spelling of the names of alkaloids and of chemicals, the example of the last or Tenth Revision of the United States Pharmacopœia is taken, in retaining the terminal "e," as in Morphine, Atropine, Codeine, also Bromine, Ethyl Chloride, etc. Certain medical periodicals, however, are accustomed to omit this final "e."

J. C. S.

Washington, D. C., June, 1920.

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PART I

DEFINITIONS, WITH EXAMPLES

Alkaloids are natural, nitrogenous, organic, basic substances. Most of these are obtained directly from plants, as Morphine from the poppy and Atropine from Belladonna. But others, known as artificial alkaloids, are made synthetically in the laboratory. Most alkaloids are very poisonous and the doses are consequently small.

Alteratives are remedies whose action may be beneficial, especially in chronic diseases, by favorably altering a deranged metabolism.

Arsenic, Iodides, Mercury, Colchicum, Phosphorus, Cod-liver Oil.

Analgesics or **Anodynes** are remedies which relieve pain.

Opium, Morphine, Aspirin, Phenacetin, Acetanilid, Antipyrine, Chloral, Belladonna.

Local Anodynes are remedies which lessen the sensibility of the skin or tissues when applied locally. Local Anodyne and Local Anesthetic are terms used almost interchangeably, the principal object in their use being the local alleviation of pain.

Procaine, Cocaine, Stovaine, Orthoform, Chloretone, Aconite, Menthol, Ethyl Chloride (spray), Ether (spray), Alcohol, Phenol.

General Anesthetics are substances used to produce unconsciousness complete enough to permit surgical operation.

Ether, Nitrous Oxide (gas), Chloroform, Ethyl Chloride, Scopolamine, Morphine.

Anthelmintics are agents used for the removal of intestinal worms.

Aspidium, Thymol, Santonin, Spigelia.

Antidotes are agents used to counteract the effect of poisons.

Antiperiodics are remedies which oppose the periodic return of symptoms.

Quinine, Arsenic, Salicylates, Iodine.

Antipyretics are agents which reduce fever.

Phenacetin, Antipyrine, Aspirin, Acetanilid, Pyramidon, Quinine, Aconite, Baths, Sponges, Cold Drinks, etc.

Antiseptics are agents which arrest the development of bacteria, not necessarily destroying them. **Germicide** and **Disinfectant** are almost synonymous terms, and signify that the agents used under these terms are strong enough to destroy micro-organisms.

Mercuric Chloride (Bichloride), Phenol (Carbolic Acid), Lysol, Cresols, Creosol, Creolin, Betanaphthol, Dichloramine-T, Carrel-Dakin Solution, 70% Alcohol, Formaldehyde, Silver Nitrate, Argyrol, Protargol, Tincture of Iodine, Hydrogen Peroxide, Boric Acid, Potassium Permanganate, Lime, Iodoform, Urotropin, Fire, Heat (moist 212°, dry 302° F.).

Astringents are agents which cause contraction of the tissues and lessen discharges.

Vegetable astringents are Tannic Acid, Gallic Acid, Galls, Oak Bark ; mineral astringents are Alum, Lead Acetate, Silver Nitrate, Zinc Sulphate, Bismuth Salts, Zinc Oxide, and Dilute Acids.

Cardiac Sedatives are agents which slow or weaken the heart's action.

Aconite, Veratrine, Chloral.

Cardiac Stimulants are agents which accelerate or strengthen the heart's action.

Digitalis, Adrenalin, Caffeine, Camphor.

Carminatives are agents which expel gas from the stomach and intestines.

Ginger, Turpentine, Asafetida, Camphor, Capsicum, and the Volatile Oils of Cloves, Cinnamon, Peppermint, Mustard, Sassafras, Fennel, etc.

Cathartics are drugs employed to cause intestinal evacuation. **Laxatives** have a mild action. Examples: Cascara Sagrada, Magnesia, Sulphur. **Purgatives** are more powerful. Examples: Calomel, Castor Oil, Aloes, Rhubarb, Senna. **Drastics** have a violent action. Examples: Croton Oil, Colocynth, Jalap, Podophyllum, Gamboge. **Hydragogues** produce copious watery stools. Examples: Magnesium Sulphate, Sodium Phosphate, Magnesium Citrate, Potassium and Sodium Tartrate.

Caustics or **Corrosives** are agents which in strong solution chemically destroy the tissues.

Nitric Acid, Sodium Hydrate.

Cerebral Depressants are agents which reduce mental activity.

Chloroform, Ether, Alcohol, Chloral, Barbitol, Opium, Hyoscine, Cannabis Indica, Bromides.

Cholagogues are agents which increase the quantity of bile secreted.

Ox Bile, Salicylates.

Demulcents are substances which protect surfaces mechanically, or soothe inflamed areas, especially mucous membranes.

Acacia (Gum Arabic), Tragacanth, Starch, Sweet Almonds, Licorice, Glycerin, Flaxseed, Honey, Barley, White of Egg, Olive Oil.

Diaphoretics or **Sudorifics** are agents which increase perspiration.

Pilocarpine, Ipecac, Dover's Powder (Ipecac and Opium), Aconite, Alcohol, Salicylates.

Diuretics are agents which increase the secretion of urine.

Caffeine, Theophylline, Theobromine, Agurin, Diuretin, Calomel, Digitalis, Strophanthus, Potassium Salts, Sodium Salts, large quantities of water or other beverages.

Ecbolics or **Oxytocics** are agents which increase uterine contractions in labor.

Ergot, Pituitrin, Quinine, Strychnine.

Emetics are agents which produce vomiting.

Alum (5-30 grs.), Zinc Sulphate (10-30 grs.), Cop-

per Sulphate (4 grs.), Tartar Emetic (1-2 grs.), Apomorphine (hypodermic $\frac{1}{10}$ gr.), Mustard (dr. 1+), Ipecac (10-30 grs.), Tepid Water in quantity, Salt.

Emmenagogues are remedies which have been supposed to restore or increase the menstrual flow.

Iron, Strychnine, Ergot.

Emollients are oily substances used to protect the skin and render it more elastic.

Lard, Mutton Suet, Vaseline, Petrolates (liquid), Oils, Glycerin, Lanolin, Salves or Ointments.

Expectorants are agents which promote the secretion and expulsion of mucus from the bronchial membrane.

Ammonium Chloride and Carbonate, Benzoin, Balsam of Peru, Balsam of Tolu, Creosote, Tar, Squill, Terpene Hydrate, Eucalyptus, Ipecac, Tartar Emetic, Apomorphine ($\frac{1}{30}$ to $\frac{1}{20}$ gr.).

Hematinics are remedies which increase the hemoglobin of the blood.

Iron, Cod-liver Oil.

Hypnotics are remedies which produce sleep. If they cause mental depression also, they are called **Narcotics**.

Alcohol, Hedonal, Sulphonal, Paraldehyde, Chloral, Barbitol, Bromides, Opium, Morphine, Codeine, Heroine, Hyoscine, Cannabis Indica.

Irritants are agents which react on the tissues, causing a local dilatation of the blood vessels. In excess these reactions are always painful.

Heat, Mustard, Cantharides, Iodine, Capsicum.

Mydriatics are agents which cause dilatation of the pupil of the eye.

Atropine, Cocaine, Hyoscyamine, Homatropine.

Myotics are agents which cause contraction of the pupil.

Physostigmine, Pilocarpine, Opium, Morphine.

Respiratory Depressants are agents which decrease the number of respirations a minute.

Opium, Morphine, Codeine, Heroine, Chloral, Alcohol.

Respiratory Stimulants are agents which increase the number of respirations a minute.

Caffeine, Strychnine, Atropine, Camphor, Ammonia, Electricity, Cold Douche.

Rubefacients or **Counter-irritants** are agents which cause reddening and irritation of the skin when applied locally.

Mustard, Turpentine, Capsicum, Cantharides, Iodine, Alcohol, Hot Poultices.

Sedatives are agents which allay excitement, irritation or pain. General Sedatives depress the central nervous system. These include narcotics and anesthetics. Local Sedatives depress sensory nerves, trunks or endings. They include local anodynes and anesthetics.

Sialogues are agents which increase the flow of saliva.

Pilocarpine, Physostigmine, Acids, Alcohol, Mercury, Iodides, Ipecac.

Stimulants are agents which increase the activity of an organ or a group of organs.

Digitalis, Caffeine, Camphor, Strychnine, Ammonia.

Stomachics or Gastric Tonics are agents which increase appetite and promote digestion.

Gentiana, Quassia, Calumba, Quinine, Strychnine, Iron, Arsenic, Alcohol, Pepper, dilute alkaline solutions before meals.

Styptics or Hemostatics are agents which arrest bleeding when applied locally.

Adrenalin, Cocaine, Ferric Chloride, Tannin, Alum, Local cold.

Tonics are agents which improve the general health, vigor, and energy of the patient.

Stomachics and Nutrients, Hygiene, Diet, Exercise or Rest, Baths, Climate, etc.

Urinary Acidifiers are agents which make the urine acid.

Benzoic Acid, Sodium-Dihydrogen Phosphate.

Urinary Alkalinizers are agents which make the urine alkaline.

Potassium Salts, Vegetable Diet.

COMMON PREPARATIONS OF DRUGS, WITH EXAMPLES

Aqua—a solution in water of a volatile substance.

Aqua Rosæ, Aqua Ammonix, Aqua Chloroformi.

Cerate—a preparation for external use, the base of which is wax, lard or petrolatum. Similar to an ointment, but firmer.

Ceratum Cantharidis.

Decoction—a solution made by boiling a substance in water.

Tea, Decoction of Dandelion.

Elixir—a sweetened aromatic alcoholic preparation.

Elixir of Gentian, of Ferric Chloride, of Pepsin, etc.

Emulsion—a preparation in which an oily substance is kept suspended in water by means of some viscid substance, such as yolk of egg, gum acacia, etc.

Emulsion of Cod-liver Oil (Emulsum Olei Morrhux).

Extract—a solid or semi-solid preparation of a drug made by evaporating a solution of the drug.

Extract of Opium (Extractum Opii).

Fluidextract—a concentrated solution of a vegetable drug, usually a tincture, of definite strength, a minim of every fluidextract being equivalent to a grain of the drug.

Fluidextract of Ergot (Fluidextractum Ergotæ),
Fluidextract of Senna (Fldext. Sennæ).

Glycerite—a mixture of a medical substance with glycerin.

Glyceritum Acidi Tannici, Glyceritum Boroglycerini.

Infusion—a solution of a vegetable substance in water without boiling.

Infusion of Digitalis (*Infusum Digitalis*), Compound Infusion of Senna (*Infusum Sennæ Compositæ*).

Liniment—an oily liquid preparation to be rubbed on the skin.

Camphor Liniment (*Linimentum Camphoræ*), Chloroform and Belladonna Liniment, etc.

Liquor—a solution in water of a non-volatile substance. Lime Water (*Liquor Calcis*), Solution of Potassium Arsenite or Fowler's Solution (*Liquor Potassii Arsenitis*).

Mixture—a preparation in which two or more substances are mixed.

Rhubarb and Soda Mixture (*Mistura Rhei et Sodæ*), Compound Licorice Mixture or Brown Mixture (*Mistura Glycyrrhizæ Compositæ*).

Ointment (*Unguentum*)—a mixture of a medical agent in a basis of lard, suet, etc., or petrolatum, for external application.

Boric Acid Ointment (*Unguentum Acidi Borici*), Mercurial Ointment (*Ung. Hydrargyri*).

Spirit—an alcoholic solution of a volatile substance.

Sweet Spirits of Nitre (*Spiritus Ætheris Nitrosi*), Whisky (*Sp. Frumenti*), Aromatic Spirits of Ammonia (*Sp. Ammoniaë Aromaticus*).

Suppository—a solid body containing a medical substance, for insertion in the vagina, rectum or urethra. Glycerin Suppositories (*Suppositoriaë Glycerini*), Opium or Belladonna Suppositories, etc.

Tablet—a solid body made by compression of a powdered drug or mixture of drugs in a suitable mold.

Sodium Bicarbonate, Calomel.

Tincture—an alcoholic, or partly alcoholic, solution of the soluble constituents of a drug.

Tincture of Aconite, Opium, etc. (*Tinctura Aconiti*, *Opii*, etc.), Tincture of Nux Vomica (*Tr. Nuc. Vom.*).

Wine—a tincture with white wine as a base.

Wine of Iron (*Vinum Ferri*), Wine of Colchicum Seed (*Vinum Colchici Seminis*).

COMMONEST METHODS OF APPLYING DRUGS

1. To the Skin

Inunctions (Oils, Liniments, Ointments, etc.)

Contact without rubbing (Baths, Blisters, Cooling Applications, etc.)

2. To Mucous Membranes

(Gargles, Sprays, Douches, Powders, etc.)

3. To Wounds and Diseased Tissues

(Antiseptic Powders, Ointments, Solutions, etc.)

4. To the Respiratory Tract

Inhalation of fumes or vapors (Anesthetics, etc.)

5. To the Circulatory System

Hypodermic Injection and Hypodermoclysis

Intramuscular Injection

Intravenous Infusion

6. To the Alimentary Canal

By Mouth (Pills, Powders, Solutions, etc.)

By Rectum (Enemata, Suppositories, etc.)

CONSIDERATIONS FOR THE MODIFICATION OF DOSAGE

Age. Young's Rule for calculating the dose for a child when the adult dose only is known.

Take the age (in years) of the child as the numerator and the age plus twelve for the denominator. The resulting fraction will be the part of the adult dose to be given. (Example: Age 3 years,

$\frac{3}{3 + 12} = \frac{3}{15}$ or $\frac{1}{5}$, which is part of adult dose to be given.)

Weight. Heavy, muscular persons require larger doses, as a rule, than those who are delicate.

To figure the dose for a child by weight, divide the child's weight in pounds by 150, which is the average weight of a man, and the resulting fraction will be the part of the adult dose given. (Example: 30-lb.

child receives $\frac{30}{150}$, or $\frac{1}{5}$ the adult dose.)

Sex. The dose for a woman is usually smaller than that for a man.

Idiosyncrasy. Certain individuals have a peculiarity of constitution whereby they are affected by a certain drug or agent in a manner entirely different from the ordinary. (Example: Quinine idiosyncrasy.)

Acquired Immunity. The injection of certain drugs in gradually increasing doses at proper intervals can often be borne without reaction. This is the basis for chronic morphinism, etc. The patient acquires a tolerance for larger and larger doses of the substance.

Pathological Conditions. The dose is modified according to the severity of the disease or the urgency of the case. Thus very large doses of Morphine are tolerated in severe pain, because the action of the drug is spent in overcoming the pain. In cases of great shock larger doses of stimulants are given than would be required in conditions of slight shock. Pregnancy, menstruation and lactation modify the doses of some drugs. Antipyretics lower fever temperature but not normal temperature when given in medicinal doses.

Accumulative Action. Some drugs are excreted from the body so slowly that the whole of one dose is not excreted before the next dose is given, consequently the amount present in the body gradually increases. (Examples: Arsenic, Digitalis.)

Time of Administration. The body is generally more resistant in the morning, especially in the case of narcotics.

Simultaneous Doses. Drugs which produce similar results (called Synergists or Adjuvants) are often prescribed together, each in correspondingly small doses. (Examples: Calomel and Aloes.) Drugs having opposite actions (called Antagonists) are sometimes given. (Examples: Chloroform and Strychnine.)

Method of Administration. As a rule, drugs act most quickly when given by intravenous injection, next when given by inhalation, next when injected deeply into the muscles, next when taken by stomach, and

lastly when injected by rectum. When applied by inunction drugs act much more slowly. The size of the dose varies with the method of application, one dose subcutaneously equaling approximately two doses by mouth and four by rectum.

PART II

TEMPERATURES, WEIGHTS, MEASURES AND SOLUTIONS

Common Thermometric Scales

Fahrenheit's scale has 32° as the melting point of ice, and 212° as the boiling point of water.

The Centigrade scale has 0° as the melting point of ice, and 100° as the boiling point of water.

Hence, one degree Centigrade is equivalent to $1.8 \left(\frac{9}{5} \right)$ degrees Fahrenheit.

Therefore, to compute the Centigrade temperature from a given Fahrenheit temperature, subtract 32, multiply by 5 and divide by 9 (*i.e.*, divide by $\frac{9}{5}$).

And to compute the Fahrenheit temperature from a given Centigrade temperature, multiply by 9, and divide by 5, and then add 32.

Centigrade and Fahrenheit Thermometric Equivalents

C. $^{\circ}$	F. $^{\circ}$	C. $^{\circ}$	F. $^{\circ}$
—40	—40	65	149
—30	—22	70	158
—20	— 4	75	167
—10	14	80	176
0	32	85	185
5	41	90	194
10	50	95	203
15	59	100	212
20	68	110	230
25	77	120	248
30	86	130	266

C.°	F.°	C.°	F.°
35	95	140	284
40	104	150	302
45	113	200	392
50	122	250	482
55	131	300	572
60	140	350	662

Equivalents of Clinical Temperatures

C.°	F.°	C.°	F.°
36.0	96.80	38.8	101.84
36.2	97.16	38.9	102.02
36.4	97.52	39.0	102.20
36.5	97.70	39.1	102.38
36.6	97.88	39.2	102.56
36.7	98.06	39.3	102.74
36.8	98.24	39.4	102.92
36.9	98.42	39.5	103.10
37.0	98.60	39.6	103.28
37.1	98.78	39.7	103.46
37.2	98.96	39.8	103.64
37.3	99.14	39.9	103.82
37.4	99.32	40.0	104.00
37.5	99.50	40.1	104.18
37.6	99.68	40.2	104.36
37.7	99.86	40.3	104.54
37.8	100.04	40.4	104.72
37.9	100.22	40.5	104.90
38.0	100.40	40.6	105.08
38.1	100.58	40.7	105.26
38.2	100.76	40.8	105.44
38.3	100.94	40.9	105.62
38.4	101.12	41.0	105.80
38.5	101.30	41.2	106.16
38.6	101.48	41.4	106.52
38.7	101.66	42.0	107.60

Apothecaries' or Troy Weight

Gr.i, = 1 grain

Gr.lx, or 60 gr. = 1 dram (℥)

℥viii, or 8 dr. = 1 ounce (℥)

℔xii, or 12 oz. = 1 pound (lb)

Apothecaries' or Wine Measure

m.lx, or 60 minims = 1 fluidram

℥viii, or 8 fldr. = 1 fluidounce

℥xvi, or 16 floz. = 1 pint

℥xxxii, or 32 floz. = 1 quart

The Metric System

This is based on the decimal system. An arbitrary *standard of length*, the *meter* (about 40 inches), is used, decimal fractions and multiples thereof being the terms for length or distance.

The *unit of capacity*, the *liter*, is formed by the contents of a cube whose edges measure one-tenth of a meter. The thousandth part of this is a cubic centimeter, or c.c.

A kilogram is the weight of one liter of distilled water under certain conditions. A thousandth part of this is a *gram* (gm.), which is the *unit of weight*.

Decimal multiples of the units are expressed by prefixing Greek numerals: Deca, 10; Hecto, 100; Kilo, 1000; and decimal fractions by prefixing Latin numerals: deci, $\frac{1}{10}$; centi, $\frac{1}{100}$; milli, $\frac{1}{1000}$. Hence:

1000. Gm. = 1 Kilogram (Kg.)
 100. Gm. = 1 Hectogram (Hg.)
 0.01 Gm. = 1 centigram (cg.)
 0.001 Gm. = 1 milligram (mg.)
 1000. M. = 1 Kilometer (Km.)
 0.01 M. = 1 centimeter (cm.)
 1 Liter = 1000 cubic centimeters (c.cm. or c.c.)
 = 1 Kilogram in weight (of water)
 1 gram = 1 c.c. in weight (of water)

Approximate Equivalents

Length

- 1 meter or Unit of Length = 40 inches
 1 inch = 2.5 centimeters (cm.)
 4 inches = 10 centimeters

Weight

- 1 Kilogram = 2.2 lbs. Avoir. or 2.7 lbs. Troy
 15 grains (gr.) = 1 gram (Gm. or gm.)
 1 grain = 65 milligrams (0.065 gm.)
 1 grain is equivalent to 1 minim
 4 grams = 1 dram

Volume

- 4 c.c. = 1 fldr.
 30 c.c. = 1 ounce
 1000 c.c. = 1 liter or approximate quart
 0.06 c.c. = 1 minim
 1 c.c. = 15 minims

1 fldr. = 1 teaspoonful, or 4 c.c., or 4 grams in weight

2 fldr. = 1 dessertspoonful, or 8 c.c., or 8 grams in weight

8 fldr. = 2 tablespoonfuls, or 30+ c.c., or 30+ grams in weight, or 1 ounce ($\frac{3}{4}$ i)

2 floz. = 1 wineglassful, or 60+ c.c., or 60+ grams in weight

4 floz. = 1 teacupful, or 120+ c.c., or 120+ grams in weight

8 floz. = 1 glassful (filled to brim), or 240+ c.c., or 240+ grams in weight

Note I. 1 : 1000 solution always means 15 grains (1 gram) to the quart ($\frac{1}{16}$ %).

Bichloride of Mercury tablets are usually $7\frac{1}{2}$ grains each. Two of these tablets in a quart of water therefore make a 1 : 1000 solution.

Note II. 1 : 100 or 1% solution always means 5 grains (or 5 minims or 325 mgs.) to the ounce. (Literally 4.8 grains.)

Normal Saline Solution ($\frac{9}{16}$ of 1%)

135 grains of salt to the quart (Note I)

9 grams (by weight) to the quart

2 drams or 2 teaspoonfuls to the quart

Note. Locke's solution is sodium chloride, 0.9 gm.; potassium chloride, 0.042 gm.; calcium chloride, 0.024 gm.; sodium bicarbonate, 0.03 gm.; dextrose, 0.1 gm.; distilled water, q. s. ad. 100 c.c.

Brief Solution Table

(Using 5 grains to the ounce for a 1% solution or Note II)

For 1 : 1000 use dr.i to a gal., or mxv to 1 qt. ($\frac{1}{10}\%$)

1 : 100 use dr.ii,mxl to 1 qt.

1 : 100 use dr.i,mxx to 1 pt.

1 : 50 use dr.v,mxx to 1 qt.

1 : 50 use dr.ii,mxl to 1 pt.

1 : 25 use dr.v,mxx to 1 pt.

1 : 20 use dr.xiii,mxx to 1 qt.

$\frac{1}{10}$ of 1%, or $\frac{1}{10}\%$ = 1 : 1000

$\frac{1}{5}$ of 1%, or $\frac{1}{5}\%$ = 1 : 500

$\frac{1}{2}$ of 1%, or $\frac{1}{2}\%$ = 1 : 200

1% = 1 : 100

2% = 2 : 100 or 1 : 50

3% = 3 : 100 or 1 : $33\frac{1}{3}$

4% = 4 : 100 or 1 : 25

5% = 5 : 100 or 1 : 20

10% = 10 : 100 or 1 : 10

20% = 20 : 100 or 1 : 5

25% = 25 : 100 or 1 : 4

50% = 50 : 100 or 1 : 2

100% = 100 : 100 or 1 : 1 (a pure drug or solution)

Rules for Solutions

Rule I. To make a weaker from a stronger solution.

Divide the strength desired (or the weaker solution) by the strength you have (or the stronger), and then multiply the amount wanted by the first result.

First be sure that the two strengths you are working with are both in terms of proportion. For instance, if one strength is in % (per cent) and the other in proportion, as 1 : 20 or 1 : 1000, change the per cent to proportion. (See table, page 19.)

Examples

I. Given a 5% (or 1 : 20) solution of Carbolic Acid to make 3 quarts of a $\frac{1}{2}$ % (or 1 : 200) solution. (Rule I.)

$$\begin{aligned}\frac{1}{200} \div \frac{1}{20} &= \frac{1}{200} \times \frac{20}{1} = \frac{1}{10} \\ 3 \text{ qts.} \times \frac{1}{10} &= 96 \text{ oz.} \times \frac{1}{10} = 9\frac{6}{10} \text{ oz.} \\ \frac{6}{10} \text{ oz.} \times 8 &= 4\frac{4}{5} \text{ drs.} \quad \frac{4}{5} \text{ drs.} \times 60 = 48 \text{ m.}\end{aligned}$$

Ans. $\bar{3}$ ix, $\bar{5}$ iv, m.xlviii of 5% Carbolic Acid and add water up to 3 quarts.

II. Given a 2% solution of Silver Nitrate to make a gallon of a 1 : 4000 solution. (Rule I.)

$$2\% = 1 : 50 \qquad \begin{array}{r} 50 \overline{) 4000} \\ \underline{80} \end{array}$$

$$1 \text{ gal.} = 4 \text{ qts.} = 128 \text{ oz.} = 1024 \text{ drs.}$$

$$80 \overline{) 1024} (12 \text{ drs.} = \bar{3}$$

$$\begin{array}{r} 80 \\ \underline{} \end{array}$$

$$224$$

$$\begin{array}{r} 160 \\ \underline{} \end{array}$$

$$\begin{array}{r} 64 \\ \underline{} \end{array}$$

$$\frac{64}{80} \times 60 = 48 \text{ m.}$$

Ans. $\bar{3}$ i, $\bar{5}$ iv, m.xlviii of the 2% solution of Silver Nitrate, and water up to a gallon.

III. Given some pure drug. (Rule I.) (A pure drug equals 100% or 1 : 1.) For instance:

To make 2 quarts of a 1% solution of Acetic Acid.

1% = 1 part of Acetic Acid to 100 parts of water.

$$2 \text{ qts.} = 64 \text{ oz.} = 512 \text{ drs.}$$

Since there is to be 1 part of Acetic Acid to 100 parts of water, we must give as many drams of Acetic Acid as there are hundreds in 512 drams, which is $5\frac{12}{100}$ drams.

$$5\frac{12}{100} \text{ drams} \times 60 = 7 \text{ m.}$$

Ans. Use $\mathfrak{z}\text{v}$, m.vii of Acetic Acid for 2 qts. of 1% solution.

Another way of working out this problem is to use Note II.

5 grs. to the oz. is a 1% solution.

$$2 \text{ qts.} = 64 \text{ oz.}$$

$64 \times 5 \text{ grs.} = 320 \text{ grs.}$, or the amount necessary for 2 qts.

$$320 \text{ grs.} = 5 \text{ drs. and } 20 \text{ m.}$$

(Divide by 60.)

(The difference in minims in the two methods is due to the fact that 5 grains to the ounce for a 1% solution is an approximate figure. Actually it should be 4.8 grains, but the 5 grains is close enough for all practical purposes.)

IV. Given a bottle of 95% Carbolic Acid. (Rule I.) (A pure drug equals 100% or 1 : 1. 95% Carbolic Acid is considered pure Carbolic because the 5% water is used to keep it in solution.)

To make 3 pts. of a 5% solution.

$$5\% = 5 : 100 \text{ or } 1 : 20.$$

$$3 \text{ pts.} = 48 \text{ oz.}$$

Since there is to be 1 part of Carbolic to every 20 parts of water, we must use as many ounces of Carbolic as there are twenties in 48 ounces, which is $2\frac{8}{10}$ ounces.

$$\frac{8}{10} = \frac{2}{5} \times 8 \text{ drs.} = \frac{16}{5} = 3\frac{1}{5} \text{ drs.}$$

$$\frac{1}{5} \times 60 \text{ m.} = 12 \text{ m.}$$

Ans. ℥ii, ℥iii, m.xii.

This problem can also be solved by the second method used in Example III, using Note II.

For 1 ounce of a 1% solution we will need 5 grains.

For 1 ounce of a 5% solution we will need 25 grains.

For 3 pints or 48 ounces we will need 48 times 25, or 1200 grains or minims, which, divided by 60, equals 20 drams.

$$20 \text{ drs.} = 2 \text{ oz. and } 4 \text{ drs.}$$

Rule II. To estimate a dose of a different fractional part of a grain from the drug on hand.

Multiply the denominator of the fraction of the grain on hand by the number of minims containing it, and multiply the result by the dose you wish to give (or divide the result by the denominator of the fraction required).

Examples

V. If m.x = gr. $\frac{1}{30}$, how would you give gr. $\frac{1}{75}$?

By Rule II, 30 (the denominator) $\times$ 10 (the number of minims) = 300. This multiplied by $\frac{1}{75}$ (the dose required) = 4 minims.

Or, If m.x = gr. $\frac{1}{30}$, 300 minims contain 1 grain, and $\frac{1}{75}$ gr. will be contained in $\frac{1}{75}$ of 300 minims, or 4 minims.

VI. If $m.x = \text{gr. } \frac{1}{30}$, to give $\text{gr. } \frac{1}{200}$. If $m.x = \text{gr. } \frac{1}{30}$, then $m. 300 = \text{gr. i}$ and $\text{gr. } \frac{1}{200} = m. \frac{300}{200} = m.\text{iss}$.

Ans. $m.\text{iss} = \text{gr. } \frac{1}{200}$.

Rule III. How to give a half of a minim.

Double the dose, add an equal amount of sterile water, then give half of that whole amount.

To give $m.\text{iss}$, take $m.\text{iii}$, add $m.\text{iii}$ of sterile water and of this 6 minims give 3 minims ($m.\text{iii}$).

VII. From a bottle of 15 grain tablets of Bichloride of Mercury, how would you make 4 quarts of 1 : 10000 solution?

15 grains to 1 qt. is a 1 : 1000 solution. (Note I.)

$4 \times 15 \text{ grs.}$ or 60 grs. to 4 qts. is still a 1 : 1000 solution.

1 : 10000 is 10 times weaker than a 1 : 1000 solution, therefore we need, for 4 qts. of a 1 : 10000 solution, $\frac{1}{10}$ of 60 grs., or 6 grs. The tablets are 15 grs. To obtain 6 grs., dissolve 1 tablet in 1 dram of water and take $\frac{6}{15}$ of the dram, or $\frac{6}{15}$ of 60 minims, which equals 24 minims.

If you have a capsule or tablet containing a larger dose than the dose ordered, dissolve it in water and give the required fraction of the solution.

For instance: Given a capsule containing 5 grains of Sodium Bicarbonate to give 2 grains. Dissolve in water and give $\frac{2}{5}$ of the solution.

VIII. Given a solution of Camphor in Oil 20%, to give 5 grains.

20% = 20 : 100 or 1 : 5 or 1 gr. in 5 minims.

Therefore to give 5 grains take 25 minims.

SOLUTIONS

Lysol—A preparation of Cresol.

Used in 1 : 200 to 1 : 50 solutions for vaginal anti-sepsis ; also (together with scrubbing with soap and water) for disinfection of hands, woodwork, etc., in contagious diseases.

Lime Water—Gastric sedative and antacid.

Prepared by dissolving unslaked lime in sterile water. Use $\frac{1}{4}$ lb. to 1 qt. of water. Allow to stand a few hours, then filter. Keep in a cool place, well corked.

Chloride of Lime Solution—For disinfecting evacuations.

Use 1 lb. to 1 gal. of cold water. Mix in a wooden pail.

Potassium Permanganate—For antiseptic irrigations and for stomach washings.

Used in 1 : 500 to 1 : 5000 solutions for irrigations and stomach wash, and in 1 : 50 to 1 : 1000 solutions for gargles, sprays, etc.

Aluminum Acetate—For antiseptic dressings and infected wounds, etc.

Acetate of Lead 38 grs.

Alum 24 grs.

Water 1 qt.

Silver Nitrate—For antiseptic irrigations, washes, for conjunctivitis (especially ophthalmia neonatorum), etc.

Solutions from 1 : 10000 to 1 : 1000 or 1 : 50.

Argyrol (A silver protein compound)—For antiseptic wash for inflammatory conditions, *e. g.*, chronic gonorrheal infections, conjunctivitis, ear infections, etc. Solutions, 5 to 25%. Liable to stain the cornea.

Protargol—Silver preparation similar to Argyrol in uses. Solutions, 0.1% up to 10%.

Tincture of Iodine—A solution of iodine in alcohol (containing 5% potassium iodide). A very efficient antiseptic. Should contain about 83% alcohol. By evaporation of the alcohol may become much more caustic.

Formalin—A solution of formaldehyde gas in water. Usually 40%.

Used in a 1 : 50 solution for disinfecting wounds and instruments, in a 1 : 25 solution for disinfecting stools, and a 1 : 400 solution for irrigating purposes.

For Fumigation.

Sufficient formaldehyde gas will be generated for 1000 cubic feet of air space by pouring over 6½ ounces of potassium permanganate crystals, 1 pint of formalin (40%).

Peroxide of Hydrogen—For cleaning pus cavities and necrotic tissue. Oxygen is liberated and pus is destroyed. For pus cavities use pure. For gargle dilute ½ to ¼. Keep in a cool place.

Bichloride of Mercury—Efficient disinfectant, except for instruments, which it corrodes; for white goods, which it discolors; and for feces and sputum, which it does not disinfect on account of the albuminous

material and ammonia usually present in excreta, which decompose the drug.

Used in a 1 : 5000 solution for many antiseptic purposes, and in a 1 : 1000 for disinfecting.

Carbolic Acid or Phenol—Antiseptic and disinfectant.

Pure Carbolic requires about 5% of water or glycerin to keep it in solution. In making solutions, hot water must be used, and the bottle must be shaken till all globules disappear, as they will burn any tissue with which they come in contact. Used in a 1 : 20 solution for disinfecting instruments, clothing, utensils and excreta, and in a 1 : 100 or 1 : 200 solution for antiseptic dressings.

Boracic Acid or Boric Acid—Antiseptic and soothing in dilute solutions. Saturated solution is 4%. Used in 1 : 50 solutions for eye and ear irrigations.

Carron Oil or Lime Liniment—Equal volumes of lime water and linseed oil. For local use, particularly for burns.

Surgical Solution of Chlorinated Soda (Carrel-Dakin Solution)—A slightly alkaline chlorinated soda solution. A rapid germicide and efficient antiseptic for infected wounds when used full strength and applied by practically continuous irrigation, as in Carrel technic. Irritating to skin, which must be protected by petrolatum. If slightly too weak, loses clinical effect; if slightly too strong, skin irritation becomes serious. Dissolves silk ligatures and loosens catgut.

Dichloramine-T—An effective germicide through its content of active chlorine. Used in 2 to 15% concentrations for dressing infected wounds, etc.

PART III

PRACTICAL CLASSIFICATION OF DRUGS

Drugs upon which emphasis has been laid are marked with a *

I. Heart Stimulants

- * Digitalis, and several of its derivatives, such as
Digitoxin, Digitalin, Digitalein, etc.
- * Caffeine Camphor Adrenalin
- * Strophanthus Squill

II. Heart Depressants

- * Aconite Veratrum (Colchicum)

III. Arteriole Constrictors

- * Adrenalin * Cocaine (locally)
- Iron Salts (*e. g.*, Ferric Chloride)
- Caffeine Digitalis

IV. Arteriole Dilators

- * Amyl Nitrite Sodium Nitrite
- * Nitroglycerin Sweet Spirits of Nitre

V. Narcotics and Hypnotics

a. Hydrocarbons

- * Alcohol * Ether * Chloroform * Ethyl Chloride
- * Chloral Sulphonal Trional * Barbital * Paral-
dehyde Hedonal Chloretone

b. Alkaloidal Narcotics

- * Opium and its derivatives, such as
- * Morphine * Codeine Laudanum * Paregoric
- Heroin * Hyoscine (Scopolamine)

c. Cannabis Indica

d.* Bromides

VI. Respiratory Stimulants

- * Caffeine * Strychnine * Atropine * Aromatic
Spirit of Ammonia

VII. Motor and Respiratory Depressants

- * Opium and its derivatives
Hydrocarbon hypnotics and narcotics

VIII. Coal-Tar Products**a. Antipyretics**

- * Acetanilid Pyramidon Salipyrin
* Antipyrine
* Phenacetin * Aspirin

These drugs not only reduce fever temperature,
but often are used as central analgesics.

b. Antiseptics

- * Carbolic Acid * Lysol * Cresol Guaiacol
* Creosote * Salicylic Acid Picric Acid
* Salol * Benzoic Acid

IX. Diuretics and Diaphoretics

- * Caffeine * Digitalis * Calomel * Squill
* Pilocarpine * Ipecac (Dover's Powder) Aconite
Potassium Acetate Theocin Agurin
Potassium Citrate Theobromine Diuretin
Coal-Tar Antipyretics

X. Internal Antiseptics

- * Quinine * Arsphenamine * Mercury Emetine
* Hexamethylenamine * Salicylates

XI. Cathartics

- a.* Laxatives and Aperients
- b.* Simple Purgatives
- c.* Drastic Purgatives
- d.* Saline Purgatives

XII. Alteratives

- * Arsenic * Iron * Iodides

XIII. Emetics

- * Apomorphine Tartar Emetic * Ipecac Alum
- * Zinc Sulphate Ammonium Carbonate * Mustard
- Copper Sulphate Sodium Chloride

XIV. Hematinics

- * Iron Arsenic

XV. Intestinal Antiseptics: Anthelmintics

- * Salol * Thymol * Calomel Guaiacol Carbonate
- Betanaphthol Quassia Santonin Aspidium
- Granatum Pepo

XVI. Intestinal Astringents

- * Tannic Acid Bismuth Subgallate
- * Iron Salts Opium Alum

XVII. Antispasmodics

- Asafetida Valerian

XVIII. Acidifiers

- Dilute Acids

XIX. Alkalinizers

- Dilute Alkalis

XX. Local Anesthetics

- * Cocaine Procaine Stovaine Chloretone, etc.
- Menthol Phenol *Ethyl Chloride

PRACTICAL CLASSIFICATION OF DRUGS

(IN GREATER DETAIL)

I. Heart Stimulants

Digitalis

Source: The Purple Foxglove. Many different preparations on the market, *e. g.*, Digitoxin, Digitalin, Digitalein.

Action: Cardiac Stimulant, Diuretic, Gastrointestinal Irritant.

Is a sharp irritant subcutaneously (except certain preparations of digitalin). Has a direct stimulating effect upon the heart muscle. Increases force but usually lowers rate of heart-beat. Usually contracts some of the peripheral blood vessels. Increases urine flow, especially in dropsy, etc. Has accumulative effect. See under Arteriole Constrictors, p. 39.

Preparation and Dosage:

Extract of Digitalis, dose, 10 mgs. ($\frac{1}{8}$ gr.)

Fluidextract of Digitalis, dose, 0.05 c.c. (1 min.)

Tincture of Digitalis, dose, 0.3 to 1 c.c. (5 to 15 mins.)

Infusion of Digitalis, dose, 8 c.c. (2 fldrs.)

Due to its accumulative effect, the total dosage of digitalis given in five or six days is more important than the single dose. 1 min. of the tincture of average strength per pound weight of patient may be given in a few hours, and then up to a total of 2

mins. per pound in average doses at six-hour intervals until the first signs of toxic dosage appear, viz., irregular pulse, or pulse-rate less than 60 per minute, or nausea or vomiting, or precordial or respiratory distress.

Symptoms of Overdosage:

Slow pulse, becoming rapid. Violent vomiting. Vertigo and pain. Dilated pupils and staring eyes. Diarrhea. Irregular, weak pulse. Rapid, feeble respiration. Delirium, stupor and convulsions. Final paralysis of the heart.

Antidote and Treatment:

Emetics and cathartics. Tannin in large quantities. Rest and quiet in a horizontal position. Ammonia, Brandy, Strychnine, Caffeine and Atropine for stimulation. Digitalis is bitter, nauseating and may interfere with digestion. May also cause sleeplessness and fainting.

Caffeine

Source: Coffee berries and tea leaves.

Action: Cardiac Stimulant, Cerebral Excitant and Diuretic.

Diminishes fatigue. Brightens the intellect. Probably stimulates the secreting cells of the kidney directly. See also under Respiratory Stimulants, p. 48.

Preparation and Dosage:

Caffeine, dose, 0.05 to 0.3 gram (1 to 5 grs.)

Caffeine Citrate, dose, 0.1 to 0.5 gram (2 to 8 grs.)

Caffeine Citrate, Effervescent, dose, 4 grams (60 grs.)

Caffeine and Sodium Benzoate, dose, 0.1 to 0.6 gram (2 to 10 grs.) By hypo, dose, 0.06 to 0.2 gram (1 to 3 grs.)

Caffeine and Sodium Salicylate, dose, 0.1 to 0.6 gram (2 to 10 grs.)

Symptoms of Overdosage:

Caffeine in toxic doses produces headache, restlessness, insomnia, giddiness, rapid feeble pulse, tremors, convulsive movements, great increase in the reflex excitability (like Strychnine), and finally profound, generalized convulsions, during which the respiration fails. In other cases the convulsions gradually become weaker and the patient dies from exhaustion.

Antidote and Treatment:

Empty stomach; give Tannic Acid and Aromatic Spirits of Ammonia for stimulation. For convulsions give a few whiffs of chloroform or ether.

Camphor

Source: Gum obtained from Camphor laurel.

Action: Heart Stimulant, Stomachic and Carminative, Diaphoretic and Expectorant. Locally, a mild irritant.

Preparation and Dosage:

Aqua Camphora, dose, 8 to 10 c.c. (2 drams)

Spirits of Camphor, dose, 0.3 to 2 c.c. (5 to 30 mins.)

Camphorated Oil is Camphor Liniment, 20% Camphor in cottonseed oil, a mild counter-irritant.

Camphor in Oil, for hypo, 20% Camphor, dose, 5 to 10 mins. Should be specially prepared.

Strophanthus

Source: Seeds of *Strophanthus Kombé*.

Action: Stimulates the heart muscle. Increases urine flow. Causes contraction of certain arterioles. Several preparations of "Strophanthin" are on the market. Used as a substitute for *Digitalis*.

Preparation and Dosage:

Tincture of *Strophanthus*, dose, 0.3 to 1.0 c.c. (5 to 15 mins.)

Strophanthin, dose, $\frac{1}{2}$ to 1 milligram by hypo ($\frac{1}{100}$ to $\frac{1}{80}$ grains)

Squill

Source: Bulb of lily family called *Scilla*.

Action: Stimulates the heart muscle. Increases urine flow. Used as a substitute for *Digitalis*. Also as an expectorant.

Preparation and Dosage:

Acetum *Scillæ*, dose, 1 to 2 c.c. (15 to 30 mins.)

Fluidextract of Squill, dose, 0.05 to 0.1 c.c. (1 to 2 mins.)

Tincture of Squill, dose, 0.3 to 1 c.c. (5 to 15 mins.)

Syrup of Squill, dose, 2 to 4 c.c. (30 to 60 mins.)

Adrenalin (Epinephrin)

Source: Suprarenal glands of sheep, cattle, etc.

Also made artificially.

Action: Vasoconstrictor and Hemostatic. When injected intravenously it stimulates the heart and also

causes a profound contraction of the arterioles, which leads to a great rise in blood pressure. This rise lasts only for one or two minutes, after which the pressure falls again to its former level or below. Injected subcutaneously or intermuscularly it causes local hemostasis with, as a rule, no rise whatever of the blood pressure; but this mode of application leads to a marked dilatation of the bronchioles in spasms of bronchial asthma.

Applied locally to mucous membranes, etc., it causes local hemostasis and blanching of the tissues. Often added in small amount to solutions injected to produce local anesthesia, etc. It is of doubtful value in most cases of shock. It has no general effect when taken by mouth but may stop local hemorrhage. See under *Arteriole Constrictors*, p. 38.

Preparation and Dosage:

Adrenalin Chloride (1 : 1000 solution). May be injected subcutaneously in doses of $\frac{1}{2}$ to 1 c.c. for asthmatic attacks, or added in very small amount to solutions of Novocaine, Cocaine, etc., for local anesthesia. May be sprayed into nose or throat, etc., in dilute solution to check bleeding.

II. Heart Depressants

Aconite

Source: Root of European plant called Monkshood. Active principle is Aconitine, very powerful alkaloid. Dose, $\frac{1}{4}$ to $\frac{1}{8}$ gr. (gr. $\frac{1}{2}$ fatal).

Commercial preparations of Aconite vary greatly in their toxicity.

Action: Cardiac and Respiratory Sedative, Diaphoretic and Diuretic, Antipyretic. Dilates arteries and decreases pressure in febrile conditions. Externally and locally slightly absorbed. Parasiticide. Locally applied has some local analgesic power in such conditions as neuralgia, etc. Irritant to stomach and causes vomiting. Powerful cardiac poison. Reduces frequency and force of heart-beat by stimulation of cardio-inhibitory center in the medulla. Hence pressure falls. Certain arterioles are dilated (particularly those of skin). Hence temperature falls. Produces a gentle perspiration. Respirations become slower.

Preparation and Dosage:

Tincture of Aconite, dose, 0.3 c.c. (5 mins.)

Fluidextract of Aconite, dose, 0.05 c.c. (1 min.)

Aconitine, 0.15 mg. ($\frac{1}{400}$ gr.)

Symptoms of Overdosage:

Tingling in mouth and skin. Constricted feeling in throat. Disorders of vision, staring eyes. Respiration very irregular and gasping. Pulse may fall to 30 or 40 per minute or become extremely irregular. Great muscular weakness and prostration. Suppressed voice. Mind usually clear except for asphyxia, which results from poor circulation and respiration and may cause convulsions. Death usually results from paralysis of the respiratory center.

Antidote and Treatment:

Emetics and lavage of stomach. Strong tea or coffee.

Tannic Acid. External heat. Atropine and Aromatic Spirits of Ammonia. Rest, quiet.

Precautions: Pulse, respiration and temperature to be carefully watched. Guard against cold air and drafts. Allow no exertion.

Veratrum

Source: Roots of Hellebore, an American and European plant.

Action: General Depressant. Reduces the strength and frequency of the pulse, possibly lowering the rate to 35 or 40. Erratic heart action may result from poisonous dose. Vagus cardio-inhibitory center in the medulla is stimulated and the heart muscle is also directly affected.

Dilatation of cutaneous vessels and fall in temperature. Very similar to Aconite in action, but not so poisonous. Consciousness not affected by moderate doses, but with poisonous doses may be lost from effects of poor circulation and respiration. Respiration slow, shallow and with large doses becomes irregular and gasping. Used empirically in eclampsia. Also rarely to reduce fever. Used locally as ointment or liniment for neuralgia.

Veratrine, the free alkaloid and its salts, the sulphate, etc.

Preparation and Dosage:

Veratrine Ointment, 4%.

Veratrine Oleate, 2%.

Fluidextract of Veratrum, dose, 0.1 c.c. ($1\frac{1}{2}$ mins.)

Tincture of Veratrum, dose, 0.5 c.c. (8 mins.)

Symptoms of Overdosage:

Nausea and vomiting. Cold, clammy skin and thread-like pulse. Rarely fatal results, though symptoms are alarming, including faintness, loss of sight and great prostration and weakness.

Antidote and Treatment:

Emetics and lavage. Strong tea or coffee. External heat. Atropine and Aromatic Spirits of Ammonia. Rest and quiet.

Colchicum

Source: Meadow Saffron, roots or seed.

Action: Cardio-Respiratory Depressant and Irritant. In therapeutic doses has but little effect on the circulation or respiration, but in poisonous doses produces severe gastrointestinal irritation. This results in collapse, with great pain and prostration, feeble, rapid, thread-like pulse, weak, shallow respiration. Moderate doses produce purgation. Its main use at present is empirically in the treatment of gout.

Preparation and Dosage:

Fluidextract of Colchicum Seed (Fluidextractum Colchici Seminis), dose, 0.2 c.c. (3 mins.)

Tincture of Colchicum Seed, dose, 2 c.c. (30 mins.)

Wine of Colchicum Seed, dose, 2 c.c. (30 mins.)

Colchicine, alkaloid, dose, 0.5 mg. ($\frac{1}{120}$ gr.)

III. Arteriole Constrictors

Adrenalin (Epinephrin). See under Heart Stimulants, p. 33.

Applied locally either as a spray or ointment to mucous membranes or raw surfaces causes great contraction of muscular walls of small arterioles. This checks hemorrhage from small vessels, but does not appreciably affect bleeding from large vessels. Injected hypodermically (usually in great dilution in a local anesthetic solution) it produces vasoconstriction in the tissues reached.

Preparation and Dosage:

With anesthetic solutions in the strength of 1 : 10000 of Adrenalin Chloride.

1 : 1000 solution may be used as spray in nose bleed, etc.

Adrenalin ointments, etc., are on the market now.

Cocaine. See under Local Anesthetics, p. 79.

Solutions of cocaine applied to mucous membranes or other tissues where the drug may reach the finer blood vessels cause local vasoconstriction. This is one of the accompanying phenomena when cocaine is used as a local anesthetic. Hemorrhage from operations on the eye or the throat, etc., may thus be much reduced by the local injection or application of cocaine.

Preparation and Dosage:

Cocaine Hydrochloride, colorless crystals, soluble in water and alcohol. Watery solutions cannot be steril-

ized by boiling without some loss, as the alkaloid tends to decompose. Solutions of various strengths are used, *e. g.*, 0.2%, 1%, 2%, 4% or even 10%.

Caffeine and Digitalis. See under Heart Stimulants, pp. 30 and 31.

These drugs have some power to cause vasoconstriction when given by stomach or hypodermically. But the arteriole contraction may be limited to certain portions of the body, *e. g.*, parts of the splanchnic area, and no very well-defined therapeutic result can, as a rule, be predicted from this action of the drugs. Other drugs of the Digitalis series might be mentioned here also.

IV. Arteriole Dilators

Amyl Nitrite, Nitroglycerin, Sodium Nitrite and Sweet Spirits of Nitre

All of these drugs tend to cause a dilatation of the arterioles, with a consequent fall in blood pressure. Amyl Nitrite is volatile and a few drops are usually poured on a cloth and inhaled like chloroform. The general blood pressure falls immediately. Small glass ampules or pearls, containing from 5 to 10 minims of Amyl Nitrite, are on the market. These ampules or pearls are broken on a cloth as needed. Nitroglycerin is generally given in tablets of $\frac{1}{100}$ gr. (These do not keep well.)

Preparation and Dosage:

Amyl Nitrite, dose, 2 to 5 drops on a handkerchief.

Spirits of Glonoin (*Spiritus Glycerylis Nitratis*), 1% of Nitroglycerin in alcoholic solution, dose, $\frac{1}{2}$ to 1 min.

Sodium Nitrite, dose, .06 to 0.1 gram (1 to 2 grs.)

Sweet Spirits of Nitre, dose, 1 to 5 c.c. (20 to 90 mins.)

V. Narcotics and Hypnotics

a. Hydrocarbons

Alcohol

Source: Made by fermentation of substances containing grape sugar. A ferment, zymase, present in growing yeast, is used in this process.

Action: Cerebrospinal Excitant, Cardiac and Gastric Stimulant, Antipyretic.

Primary stimulation of the central nervous system, followed by a depression. Best authorities consider primary effects not really stimulant but deceptive, and result of a depression of the higher controlling and inhibiting functions of the brain. Small doses act as a local stimulant to the gastric mucosa. Marked effect on nervous system; deadens control of mind and moral sense. Large doses may lower temperature by dilatation of the skin vessels. When excitement is produced the heart rate and respiration may be slightly accelerated, but this rapidly changes to depression and slowing as the dose is increased. A sufficiently large dose causes depression and coma, ending in death from respiratory paralysis. After smaller doses recovery, accompanied by vomiting and

great weakness and prostration, may take place in twelve to twenty-four or forty-eight hours. About 95% of the alcohol ingested is oxidized in the body. The remainder is slowly excreted. Small repeated doses of alcoholic beverages are sometimes given as a food in cases of prolonged fever, etc. In well-selected cases, especially in patients accustomed to its use, it may be very valuable as a diffusible stimulant, diaphoretic and hypnotic.

Externally, alcohol is a rubefacient and astringent, and by its evaporation a refrigerant, being thereby useful in reducing fever. It is used to harden and cleanse the skin, and also as a mild counter-irritant. In the concentration of 70% it is markedly antiseptic.

Ether

Source: A highly volatile, inflammable liquid produced by the action of strong sulphuric acid on ordinary alcohol.

Action: Anesthetic, Cardiac and Respiratory Depressant.

Applied locally (especially as a spray) its rapid evaporation may cause sufficient cold to act as a local anesthetic. A fat solvent. Bitter and irritating to the mouth and respiratory passages. May reflexly cause excitement and struggling, which in turn may accelerate the heart and respiration. Direct action on the heart and respiration is depressant, the final cause of death being paralysis of the respiratory center. Most extensively used general anesthetic, given by inhalation. Excreted mainly by the lungs.

Recovery from Surgical Anesthesia:

Patients should be kept warm and out of drafts, fresh air should be abundant, vomitus or excessive mucus should be sponged out of the mouth (the head being turned to one side if necessary) and patient must be watched for surgical shock and collapse.

Hoffman's Anodyne (Compound Spirits of Ether).
Carminative and Stimulant, dose, 10 mins. to 1 fldr.

Chloroform

Source: A volatile liquid formed by the action of chlorinated lime on methyl alcohol.

Action: Similar to ether but more depressant, especially on the heart and respiration. Less irritating to the air passages, non-inflammable, more agreeable to the patient. After effects more dangerous than those of ether, as a rule; the heart, kidney and liver being particularly liable to be injured by chloroform, while the lungs and respiratory passages may be affected by ether. Chloroform is given by inhalation. Also used in liniments.

Ethyl Chloride, a highly volatile liquid, of which the vapor is very inflammable. Used by inhalation as general anesthetic for short operations where short, rapidly induced anesthesia is desired. Also used as spray for local intense cold and local anesthesia.

A considerable number of other drugs are used to produce sleep or to relieve pain or convulsions, excitement, etc. Among these may be mentioned:

Chloral Hydrate, colorless crystals, with a penetrating odor and a somewhat bitter taste, readily soluble in water, usually given in dilute solution in syrup. Dose, 0.5 gram (8 grs.)

Barbital, for which "Veronal" is one manufacturer's name. Colorless crystals given in hot water, tea, or milk, being less insoluble in hot liquids than in cold. In small doses, a relatively safe hypnotic, used in simple insomnia as well as in that accompanying hysteria, neurasthenia, and mental disturbances. Dose, 0.3 to 1.0 gram (5 to 15 grs.). Habit-formation is possible.

Barbital-Sodium, similar to Barbital, but much more soluble and therefore supposed to act more rapidly.

Chlorbutanol, for which "Chloretone" is one manufacturer's name. Colorless crystals, slightly soluble in water, very soluble in alcohol, may be given in (1%) aqueous solution or, better, in tablets. Dose, 0.3 to 1 gram (5 to 15 grs.)

Paraldehyde, colorless fluid, strong characteristic odor and burning taste. Given in brandy and water, or in ice-water (up to 10%), or in capsules. Dose, 1 to 4 c.c. (15 to 60 mins.)

Sulphonmethane (Sulphonal), crystalline white powder. Given in powder or in hot water or milk. Dose, 1 gram (15 grs.)

Sulphonethylmethane (Trional). Similar to sulphonal. Dose, 1 gram (15 grs.)

Hedonal, crystalline powder. Given in powder or tablets. Dose, 2 grams (30 grs.)

b. Alkaloidal Narcotics

Opium. (Morphine, Codeine, Heroine, Laudanum, Paregoric)

Source: The juice obtained by incision of the unripe capsules of the opium Poppy. Opium itself is a brownish, gumlike substance, or else it may be reduced to a brownish powder. The pure alkaloids, Morphine, Codeine, Heroine, etc., are white powders. Action: Analgesic, Hypnotic, Myotic, Secretory Depressant. Allays peristalsis. Bitter taste. Sweetish narcotic odor.

Opium and its derivatives depress the central nervous system and cause sleep and insensibility to pain. Circulation is not much affected directly. Secretions, with exception of perspiration, are decreased. Respirations are slowed and usually become shallower. After large doses they become irregular (Cheyne-Stokes type).

Chronic poisoning may result from constant use of Opium or some of its derivatives (*e. g.*, Morphine habit). Children and infants are extremely susceptible to these poisons, and the greatest possible care must be used in their administration to such patients. Death results from paralysis of respiratory center. Opium and Morphine are mainly excreted by intestines. Codeine by urine. It is claimed that a nursing

child may be affected through its mother's milk if she takes one of these drugs.

Preparation and Dosage:

Powdered Opium (Opii Pulvis), 10% of Morphine.

Dose, 0.02 to 0.1 gram ($\frac{1}{3}$ to $1\frac{1}{2}$ grs.)

Extract of Opium, 20% of Morphine. Dose, 0.015 to 0.03 gram ($\frac{1}{4}$ to $\frac{1}{2}$ gr.)

Laudanum (Tincture of Opium), 10% of Opium; 1.0% of Morphine. Dose, 0.3 to 1 c.c. (5 to 15 mins.)

M.x equals 1 gr. of Opium, or $\frac{1}{10}$ gr. of Morphine.

Tincture of Deodorized Opium. Dose, 0.3 to 1 c.c. (5 to 15 mins.)

Dover's Powder, 10% each of Opium and Ipecac and 80% of Sugar of Milk. Dose, 0.3 to 1 gram (5 to 15 grs.)

Paregoric (Camphorated Tincture of Opium). Dose for an adult, 4 to 15 c.c. (1 to 4 fldrs.); for a child, 0.3 to 1 c.c. (5 to 15 drops) ($\frac{1}{2}$ oz. equals 1 gr. Opium)

Morphine, Morphine Hydrochloride, Morphine Sulphate and Morphine Acetate. Dose of each, $\frac{1}{12}$ to $\frac{1}{2}$ gr. (much less for babies)

The salts are soluble in water.

Majendi's Solution of Morphine. Dose, m.v to x (m.xxx equals 1 gr. of Morphine)

Codeine, Codeine Phosphate, Codeine Sulphate. Dose of each, $\frac{1}{4}$ to $\frac{1}{2}$ gr.

The salts are fairly soluble in water.

Symptoms of Overdosage:

Morphine, gr. $\frac{1}{2}$, and Opium, gr. iii, may produce death. Contracted pupils, drowsiness, deepening stupor, no response to external stimuli, skin moist and clammy, becoming cyanotic. Respirations slow, rate 4 to 6 a minute. Feeble pulse. Coma, pin-point pupils. Death from failure of respirations in 4 to 12 hours.

Treatment:

Evacuate stomach by tube if possible. Emetics. Destroy poison in stomach with Potassium Permanganate (1 : 2000). Give strong tea or coffee. Tannic Acid (contained in strong tea). Tannic Acid forms Morphine Tannate from the Morphine present in the stomach. Should be washed out, for the Hydrochloric Acid of the gastric juice may break down the tannate after a time and form the soluble Morphine Hydrochloride which is readily absorbed. Keep patient awake. Give Aromatic Spirits of Ammonia, Strychnine or Atropine. Catheterize patient if necessary. Stomach should be repeatedly washed out with Potassium Permanganate (1 : 2000), for a part of the poison is excreted into the stomach and if not removed will be reabsorbed.

Hyoscine (Scopolamine)

Source: The alkaloid obtained from *Hyoscyamus*, *Scopola*, etc.

Action: Sedative and Hypnotic, especially in maniacal excitement, delirium tremens, "Twilight Sleep,"

etc. Mydriatic, and in large doses paralyzes the vagus endings in the heart and secretory nerve endings in glands. Most Belladonna preparations contain Hyoscine, which is present in *Atropa Belladonna*. Hence Belladonna preparations often depress the central nervous system. This is due to the Hyoscine and not to the Atropine, as ordinarily taught. Depressant action somewhat resembles that of Codeine. See also Atropine, whose peripheral paralysis of nerve endings is practically identical with that of Hyoscine.

Preparation and Dosage:

Hyoscine Hydrobromide (identical with Scopolamine Hydrobromide), colorless, transparent crystals, acrid, bitter taste, very soluble in water. Dose, 0.0003 to 0.0005 gram, $\frac{1}{3}$ to $\frac{1}{2}$ milligram ($\frac{1}{200}$ to $\frac{1}{100}$ gr.)

c. **Cannabis Indica**

Source: Flowering tops of *Cannabis Sativa* or Indian Hemp.

Action: Hypnotic, occasionally used instead of Morphine. Produces sleep in about 50% of cases. Does not disturb digestion; no subsequent nausea or depression; useful in sleeplessness from nervous exhaustion, less often from pain. Sometimes used for migraine and in mental diseases.

Preparation and Dosage:

Extract of *Cannabis Indica*, dose, 0.015 gram ($\frac{1}{4}$ gr.)

Fluidextract of *Cannabis Indica*, dose, 0.1 c.c. (2 mins.)

Tincture of Cannabis Indica, dose, 1 c.c. (15 mins.)
Commercial preparations are often inert and should be carefully tested.

d. Bromides

Source: Bromine, a non-metallic element found in sea water and in the product of certain salt works.

Action: Depression of central nervous system. Hypnotic and Sedative. Used to produce sleep, to quiet nervous excitement in epilepsy, seasickness, etc.

Preparation and Dosage:

Sodium Bromide, Potassium Bromide and Ammonium Bromide are in general use. Dose, 0.6 to 1.0 grams (10 to 15 grs.)

VI. Respiratory Stimulants

Caffeine

Source: Coffee berries and tea leaves.

Action: Stimulation of psychic areas, vasomotor and respiratory centers, stimulation of central nervous system in large doses; increased diuresis; decreased fatigue. See also under Heart Stimulants, p. 31.

Preparation and Dosage are given on p. 31.

Strychnine

Source: Alkaloid from *Nux Vomica*, East Indian plant.

Action: Spinal, and possibly Cerebral, Respiratory and Vascular Stimulant. Stomachic. Externally and

locally poisons vermin. Has bitter taste. Increases flow of saliva. Increases appetite. Acts through the central nervous system possibly to stimulate the respiratory and vascular systems. May have accumulative effect.

Preparation and Dosage:

Extract of Nux Vomica, dose, 0.015 to 0.06 gram.
($\frac{1}{4}$ to 1 gr.)

Fluidextract of Nux Vomica, dose, 0.05 c.c. (1 min.)

Tincture of Nux Vomica, dose, 0.3 to 1 c.c. (5 to 15 mins.)

Strychnine, dose, 0.001 to 0.002 gram ($\frac{1}{80}$ to $\frac{1}{30}$ gr.)

Strychnine Nitrate or Sulphate, dose, 0.001 to 0.002 gram ($\frac{1}{80}$ to $\frac{1}{30}$ gr.)

Syrup of Iron, Quinine and Strychnine Phosphate, dose, 4 to 8 c.c. (1 to 2 fldrs.)

Symptoms of Overdosage:

Restlessness, nervousness, twitching of the fingers, etc. Reflex excitability is greatly increased. If dose is large enough, this rapidly leads to most profound generalized convulsions. These come on in spasms which last from a few seconds to two or three minutes. The patient then relaxes for a short time. In a little while the excitability of the cord increases to such an extent that a slight touch or sound may serve to start another convulsion. Rigidity. Opisthotonos (bending back of head, neck and shoulders and of legs and hips). Staring eyes, "Risus Sardonius" (sardonic grin). Mind usually clear ex-

cept for asphyxia from lack of respiratory movements during convulsions. Death due to paralysis of respiratory center.

Antidotes and Treatment:

Tannic Acid (strong tea), emetics (Apomorphine, Zinc Sulphate). Lavage of stomach (Potassium Permanganate). Chloroform or Ether may be used to control convulsions. Catheterization. Quiet. Diuresis. When giving Strychnine in any form, restlessness and twitching are always to be watched for. Strychnine poisoning is characterized by a series of spasmodic convulsions with intervals of quiet. Tetanus produces less severe but continuous spasm, which is especially developed in the jaw muscles.

Atropine

Source: From *Atropa Belladonna* (Deadly Nightshade).

Action: Cardiac and Respiratory Stimulant, Secretory Depressant, Mydriatic, Cerebral Excitant (large doses).

Most important actions: 1. To stimulate respirations. 2. To relieve spasms of involuntary muscles, as from stones in gall bladder, cathartic gripes, lead colic, etc. 3. To dry secretions of stomach, nose, sweat glands, etc. Externally and locally some benumbing effects. (Belladonna plaster, ointment and liniment.) Commercial preparations often contain Hyoscine (Scopolamine), which tends to cause sleep.

Atropine is often given before an anesthetic to check secretions in mouth, throat, etc. (and to prevent reflex inhibition of the heart with chloroform). Also used in asthma.

Symptoms of Overdosage:

Rash. Pupils bright and staring. Dry, flushed skin. Dry throat, with difficulty in swallowing. Headaches, illusions and delirium. Rapid pulse, out of proportion to respirations. Symptoms somewhat like scarlet fever, except for dilated pupils.

Antidote and Treatment:

Evacuate stomach and treat symptoms. Catheterize. Apply external heat. Artificial respiration. Give Tannic Acid and wash out stomach. Convulsions may be controlled by ether inhalations.

Preparation and Dosage:

Extract of Belladonna Leaves, dose, 0.015 gram ($\frac{1}{4}$ gr.)

Belladonna Ointment (0.14% of alkaloids)

Tincture of Belladonna Leaves (0.035% of alkaloids), dose, 0.3 to 1 c.c. (5 to 15 mins.)

Belladonna Liniment contains Camphor.

Stramonium (Thorn Apple or Jamestown Weed) and **Hyoscyamus** (Henbane) also contain Atropine, as well as varying quantities of Hyoscyamine and Hyoscine. See also under Alkaloidal Narcotics and Hypnotics, p. 47.

Ammonium Preparations

Source: From NH_4OH , by various substitutions.

Action: Stimulation of central nervous system, of respiratory center, etc.; increase of reflexes, of sweat center, etc.

Liquefying expectorant. Used in many "cough mixtures." Used in asthma, edema of the lungs, pneumonia, in resuscitation from fainting, anesthesia, poisoning, etc.

Preparation and Dosage:

Ammonium Carbonate, dose, 0.12 to 1 gram (2 to 15 grs.), largely diluted.

Aromatic Spirits of Ammonia, dose, 2 to 4 c.c. ($\frac{1}{2}$ to 1 dr.) in a glass of water. Sugar may be added to improve the taste.

Ammonium Chloride, dose, 0.06 to 0.6 gram (1 to 10 grs.)

Liquor Ammonium Acetate (Spiritus Mindereri), 2 to 30 c.c. ($\frac{1}{2}$ to 8 fldrs.)

VII. Motor and Respiratory Depressants

Opium and its derivatives, Morphine, Codeine, Heroine, etc. See under Alkaloidal Narcotics and Hypnotics, p. 44.

All of these bodies depress the respiratory center. They also lessen the movements and excitement of the patient, and thus indirectly lessen the respiratory rate. The Hydrocarbon Hypnotics and Narcotics also lessen the irritability of the respiratory center. For description see p. 40.

VIII. The Coal-Tar Products

a. Antipyretics

Source: Tar which is formed in the manufacture of illuminating gas from coal.

The Antipyretic Group are used chiefly to lower fever temperature. Their chemistry and action are, however, closely related to the **Antiseptic Group**, which is distinguished by a much more marked local action on protoplasm whereby bacteria and other living organisms are injured or killed.

Antipyretics cause a slight primary stimulation of the central nervous system, followed by more marked depression resulting in collapse, if the dose is large enough.

Lower fever temperature by action on heat regulating centers in brain. Central analgesic action (in headaches, etc.). Irritate or coagulate protoplasm when locally applied in sufficient concentration. Possess some local anesthetic power. The simpler members (chemically) are as a rule more easily broken down in the blood to form simple Phenol (Carbolic Acid) derivatives, and hence are more poisonous, *e. g.*, Acetanilid. Tendency to depression of heart and circulation in general. Skin vessels dilate and patient sweats, the fever thereby being lowered. Most proprietary "headache powders" or tablets contain one of these drugs, often Acetanilid, which is one of the most dangerous.

Preparation and Dosage:

Acetanilid (Antifebrin), dose, 0.06 to 0.3 gram (1 to 5 grs.)

Antipyrine, dose, 0.3 to 0.6 gram (5 to 10 grs.)

Phenacetin, dose, 0.3 to 1 gram (5 to 15 grs.)

Pyramidon, dose, 0.3 to 0.4 gram (5 to 6 grs.)

Acetyl Salicylic Acid (Aspirin), dose, 0.3 to 1 gram (5 to 15 grs.)

Salipyrin, dose, 0.3 to 2.0 grams (5 to 30 grs.)

Rarely certain symptoms (idiosyncrasies) are produced by these drugs. Among these are skin eruptions, itching, fever, profuse sweating, shivering and rigors, catarrh and burning of throat and mouth, mental dullness, etc., collapse, cyanosis, weak heart, etc.

Symptoms of Overdosage:

Prostration; heart first rapid and feeble, then slow; marked cyanosis; convulsive movements; cold, clammy skin; subnormal temperature and finally death from failure of the circulation.

- b. **Antiseptics** are characterized by a coagulating action on proteid which kills or injures cells, bacteria, etc., with which they come in contact and results in irritation and inflammation. Central nervous system is first stimulated, then depressed. Skin becomes blue and urine dark (smoky). Poisoning is similar but much more severe than with the Antipyretics.

Preparation and Dosage:

Carbolic Acid (Phenol), colorless or reddish crystals.

Soluble in 20 parts of water.

Ointment, 2.25% in white petrolatum.

Glycerite, a 20% solution in glycerine.

Dobell's Solution (0.3% of phenol), see p. 90.

Creosote, oily liquid, smoky odor, dose, 0.05 to 0.3 c.c.
(1 to 5 mins.)

Creosote Carbonate, dose, 15 grains.

Lysol, a proprietary disinfecting solution.

Guaiacol, colorless crystals, or fluid, agreeable aromatic odor, soluble in 53 parts water and in alcohol. Dose, 0.5 c.c. (8 mins.)

Guaiacol Carbonate, almost tasteless powder, dose, 0.2 to 0.5 gram (3 to 8 grs.)

Ichthyol and Tar, used in ointments, etc.

Salicylic Acid, generally prepared from Phenol, but also derived from Salicin or the natural salicylates, Oil of Wintergreen (Gaultheria) or Sweet Birch. Antiseptic, Antipyretic and Germicide, Cholagogue and Intestinal Antiseptic. Overdosage produces buzzing and roaring in the ears, disturbance of vision, excessive sweating, delirium, cardiac and respiratory depression. Used in acute rheumatic fever, etc. Dose, Sodium Salicylate, 0.3 to 2 grams (5 to 30 grs.)

Phenyl Salicylate (Salol). Intestinal antiseptic, splits up into Salicylic Acid and Phenol in the alimentary canal. Dose, 0.06 to 0.6 gram (1 to 10 grs.)

Oil of Wintergreen (Methyl Salicylate, Oleum Gaultheria), dose, 1 c.c. (15 mins.)

Salicin, dose, 0.5 to 1 gram (8 to 15 grs.)

Benzoic Acid, dose, 0.3 to 1 gram (5 to 15 grs.)

Sodium Benzoate, dose, 0.3 to 1 gram (5 to 15 grs.)

Compound Tincture of Benzoin, dose, 2 c.c. (30 mins.)
Often used externally.

Balsam of Peru. Used externally, in ointments to stimulate indolent wounds, etc.

Cresol, straw-colored fluid, phenol odor, soluble in 60 parts water, dose, 0.05 c.c. (1 min.) Action similar to phenol but four times more germicidal.

Liquor Cresolis Compositus. Cresol, 50%, suspended in water by means of soap, used in diluted form as a surgical disinfectant.

Picric Acid, used as a local application for burns, erysipelas, etc. Crystals are explosive.

IX. Diuretics and Diaphoretics

Caffeine, Digitalis, Squill. See under Heart Stimulants, (1), p. 27.

Calomel, Mercurous Chloride (Hydrargyri Chloridum Mite, Hg_2Cl_2 or HgCl), is a bland, heavy powder, insoluble in water. Used extensively as a cathartic, especially in fermentative conditions of the stomach and bowels and auto-intoxication. Mild antiseptic

action in the bowels. Does not increase the flow of bile as formerly believed, but the increased peristalsis may move forward more quickly than normal the bile which is poured into the intestines. Hence the stools may be greenish (from unchanged biliverdin). A saline cathartic should usually be given from three to eight hours after a dose of Calomel to flush out the bowels. Calomel also acts as a diuretic, especially in dropsy. Calomel is sometimes used in the treatment of syphilis, but other salts of mercury are better. Dosage: Hydrargyri Chloridum Mite, 0.03 to 0.2 gram ($\frac{1}{2}$ to 3 grs.), but often several doses of $\frac{1}{10}$ gr. each are given.

Chronic poisoning may result from use of mercury in any form. The symptoms are salivation and stomatitis, diarrhea and digestive troubles, anorexia, cachexia, skin eruptions, tremor, etc.

Potassium Acetate and Citrate. These salts increase the urine flow and also render it alkaline. Dose of each, 1 gram (15 grs.)

Theobromine, Diuretin, Agurin, Theocin

All of these bodies are diuretics which stimulate the secretory cells of the kidney directly. They are all related chemically and pharmacologically to Caffeine. See p. 31. They do not, however, possess so extensive an action on the central nervous system as does Caffeine. Theobromine occurs in chocolate, Theocin in tea leaves (in minute quantities).

Preparation and Dosage:

Theobromine, dose, 0.5 gram (8 grs.) three times a day.

Diuretin (Theobromine-sodium-salicylate) is more soluble. Dose, 0.5 to 1 gram (8 to 15 grs.) three times a day.

Agurin (Theobromine-sodium-acetate) is similar to Diuretin. Dose, 0.5 to 1 gram (8 to 15 grs.) three times a day.

Theocin is an artificial Theophyllin. Dose, 0.2 to 0.3 gram (3 to 5 grs.)

Pilocarpine

Source: *Pilocarpus Jaborandi*. This alkaloid increases most of the secretions. It also stimulates the endings of the vagus inhibitory nerves in the heart and may thus slow the beat, especially in poisoning. The medicinal dose is, however, usually too small to slow the heart. Used especially to increase sweat, also as miotic.

Preparation and Dosage:

Pilocarpine Hydrochloride, dose, 0.003 to 0.005 gram ($\frac{1}{20}$ to $\frac{1}{12}$ gr.) by hypodermic.

Pilocarpine Nitrate, dose, 0.003 to 0.005 gram ($\frac{1}{20}$ to $\frac{1}{12}$ gr.) by hypodermic.

Ipecac

Source: Root of a Brazilian plant.

Action: Emetic, Expectorant (not as depressant, as Tartar Emetic), increases and makes more fluid the

secretion of the bronchial mucous membrane. Dover's Powder is often used for cough as well as a diaphoretic, and in chills, and in commencing catarrh of the respiratory passages. Ipecac has been used extensively in dysentery, especially amebic, in which it seems almost specific. The chief active principle of Ipecac is Emetine. In the last few years this drug has been given, with marked success, hypodermically in the treatment of amebic dysentery. From $\frac{1}{2}$ to 1 grain is given daily or every other day. From three to five doses have thus been found sufficient by some to stop the disease, but often much more is required.

Preparation and Dosage:

Syrup of Ipecac, dose, Expectorant, 1 c.c. (15 mins.) ;
Emetic, 15 c.c. (4 fldrs.)

Wine of Ipecac, dose, Expectorant, 1 c.c. (15 mins.) ;
Emetic, 15 c.c. (4 fldrs.)

Tincture of Ipecac and Opium (contains 10% opium), dose, 0.5 c.c. (8 mins.)

Dover's Powder (*Pulvis Ipecacuanhæ et Opii*, 10% each of Ipecac and Opium), dose, 0.5 gram (8 grs.)

Emetine Hydrochloride, Expectorant, dose, 0.005 to 0.01 gram ($\frac{1}{12}$ to $\frac{1}{6}$ gr.) ; hypodermically, $\frac{1}{2}$ grain to $\frac{3}{4}$ for amebic dysentery.

Aconite. See under Heart Depressants, p. 34. Aconite produces a gentle perspiration.

Antipyretics. Most of the Coal-Tar Antipyretics cause perspiration when given to reduce fever. See under Coal-Tar Antipyretics, p. 53.

X. Internal Antiseptics

Quinine

Source: The bark of *Cinchona Calisaya*, etc.

Action: Quinine in sufficient quantities acts as a poison to all living protoplasm. It will also inhibit the actions of ferments. The general metabolism of the body is affected in such a manner as to lessen the amount of heat production and consequently a fever temperature may be lowered. (Antipyretic action.) Quinine exercises a selective toxic action on the malaria organism, which is killed in the blood of the patient by quantities of the drug which are harmless to the patient. The central nervous system under small doses undergoes some slight indefinite stimulation, which is followed by depression as the dose is increased.

Quinine is chiefly used for its specific action in malaria. It is also often prescribed in neuralgia and headaches, colds, and as a bitter stomachic.

Symptoms of Overdosage:

Headache, ringing in the ears and disturbed vision. This complex symptom is known as cinchonism. Skin eruptions also sometimes occur. Idiosyncrasies occasionally develop under the use of quinine. Quinine is also used as an ecboic and as a bitter stomachic.

Preparation and Dosage:

Tincture of *Cinchona*, 4 c.c. (1 fldr.)

The salts (sulphate, bisulphate, dihydrochloride, hydrochloride and salicylate) of Quinine, 0.3 to 1 gram (5 to 15 grs.)

Syrup of Iron, Quinine and Strychnine Phosphate,
4 c.c. (1 fldr.)

Elixir of Iron, Quinine and Strychnine Phosphate,
4 c.c. (1 fldr.)

Quinine and Urea Hydrochloride, very soluble in water and much less irritating than ordinary quinine salts. Dosage: Hypodermic, 1 gram (15 grs.) daily. For local anesthesia by hypodermic, 0.25 to 1% solution.

Arsphenamine and Neoarsphenamine

These are both arsenic compounds, the latter being a soluble modification of arsphenamine. Both are used in the treatment of syphilis.

Particular manufacturers' preparations of these drugs are called Salvarsan, Arsaminol, Arsenobenzol, and Diarsenol (and Neosalvarsan, etc.).

Arsphenamine dosage, from 0.3 to 0.6 gram (5 to 9 grs.)

Neoarsphenamine dosage: For men, 0.6 to 0.9 gram (9.5 to 14 grs.); for women, 0.45 to 0.75 gram (7 to 12 grs.); for children, 0.15 to 0.3 gram (2 to 5 grs.)

Solutions of Neoarsphenamine must be injected immediately after their preparation. Sterile freshly distilled water should be used. The solution must not be warmed and the temperature of the injection fluid should not be more than 20° to 22° C. (68° to 72° F.). Exact printed instructions for the preparation of the solution usually are enclosed in the wrapper with the drug. The contents of a tube of either drug should

be used at once after opening and under no conditions should the contents of a tube damaged in transportation, or any remnant of the powder from previously used tubes, be employed. Neoarsphenamine, particularly, oxidizes rapidly and becomes toxic.

Mercury. See also section under Calomel, p. 56. Mercury is used in the treatment of syphilis, especially in the active stages, often combined with Iodides or Arsphenamine. Mercury here acts by killing the *Spirochæte Pallidum*, the organism of syphilis. In the treatment of this disease Mercury in some of its forms may be given by mouth, by inunction, by hypodermic or intramuscular injection, etc. Mercury is also used as a purgative, as a diuretic, as an external disinfectant, in skin diseases, etc. Bichloride of Mercury is often taken with suicidal intent.

In acute poisoning the stomach should be emptied repeatedly, preferably by the tube. Tannic Acid, eggs, milk or other albuminous substances may be given to precipitate the metal. The stomach should be emptied after these and powerful catharsis used to prevent the later absorption of the Mercury. The later treatment is largely symptomatic. In chronic poisoning the mouth should be kept well cleansed. The diarrhea may be checked by opium.

Preparation and Dosage:

Bichloride of Mercury (*Hydrargyri Chloridum Corrosivum*, Corrosive Sublimate, Mercuric Chloride, HgCl_2) is often used in dilute solution as a disin-

fectant (1 in 1000 to 4000). Death has resulted from taking 3 grains. Dose, 2 to 4 milligrams ($\frac{1}{32}$ to $\frac{1}{16}$ gr.)

Red Iodide of Mercury, Biniodide of Mercury (Hydrargyri Iodidum Rubrum, HgI_2). Dose, 2 to 4 milligrams ($\frac{1}{32}$ to $\frac{1}{16}$ gr.)

Donovan's Solution (Liquor Arseni et Hydrargyri Iodidi) contains 1% each of Arsenic Iodide and Red Mercuric Iodide. Dose, 0.05 to 0.5 c.c. (1 to 8 mins.)

Calomel (Mercurous Chloride, HgCl , Hydrargyri Chloridum Mite). Dose, 0.03 to 0.2 gram ($\frac{1}{2}$ to 3 grs.), but often $\frac{1}{10}$ gr. is given in repeated doses, if desired.

Mercury with chalk, Gray Powder (Hydrargyri cum Creta). Dose, 0.1 to 0.5 gram (2 to 8 grs.)

Blue Mass, Blue Pill (Massa Hydrargyri), 33% Mercury. Dose, 0.25 gram (4 grs.)

Blue Ointment (Unguentum Hydrargyri), 50% Mercury.

Unguentum Hydrargyri Dilutum, 33 $\frac{1}{3}$ % Mercury.

Unguentum Hydrargyri Ammoniati, 10% Mercury.

Salicylates. See under Coal-Tar Antiseptics, p. 55. The Salicylates are used regularly in the treatment of rheumatic conditions, and often (mixed with colloidion and Tincture of Hyoscyamus, etc.) to remove corns, etc.

Hexamethylenamine (for which there are various trade names, such as Urotropine). This drug is used extensively as a urinary disinfectant. It has also been

recommended in gall-bladder infections, in pyelitis, in colds and meningeal infections. Its antiseptic action depends on its power to break down with the liberation of formaldehyde. This readily occurs in acid solutions, but only slowly and imperfectly in neutral or faintly alkaline solutions. Hence its use in many infectious conditions has been much discussed recently. Its greatest value appears to lie in its antiseptic action in acid urine. Dose, 0.2 to 0.6 gram (3 to 10 grs.), to be taken in a glass of water.

Emetine. This drug (from Ipecac) has been used extensively, both hypodermically and by stomach, in the treatment of amebic dysentery. See under Diuretics and Diaphoretics, p. 59.

XI. Cathartics

a. Laxatives and Aperients (mild drugs which simply serve to hasten intestinal evacuation).

Olive Oil. Dose, 30 c.c. (1 oz.) or more.

Sulphur, Magnesia, Euonymus, Butternut, Tamarind, etc.

b. Simple Purgatives (produce active peristalsis and griping pain. Small doses may act as laxatives only).
Aloes (Aloe Purificata), dose, 0.06 to 0.6 gram (1 to 10 grs.)

Rhubarb (Extractum Rhei), dose, 0.2 to 0.3 gram (3 to 5 grs.)

Senna (Fluidextractum Sennæ), dose, 4 to 8 c.c. (1 to 2 fldrs.)

Black Draught (*Infusum Sennæ Compositum*), dose, 30 to 60 c.c. (1 to 2 ozs.)

Castor Oil (*Oleum Ricini*), dose, child, 4 to 15 c.c. (1 to 4 drs.) ; adult, 15 to 30 c.c. ($\frac{1}{2}$ to 1 oz.)

Calomel (*Hydrargyri Chloridum Mite*), dose, 0.006 to 0.2 gram ($\frac{1}{16}$ to 3 grs.)

Blue Mass, dose, 0.065 to 0.25 gram (1 to 4 grs.)

Cascara Sagrada (*Rhamnus Purshiana*), Fluidextract, dose, 0.6 to 2.0 c.c. (10 to 30 mins.) Aromatic fluidextract is pleasanter but rather less effective.

c. Drastic Purgatives (produce intense action, watery stools and much pain).

Croton Oil (*Oleum Tiglii*), dose, 0.03 to 0.12 c.c. ($\frac{1}{2}$ to 2 mins.)

Colocynthis (*Extractum Colocynthidis*), dose, 0.016 to 0.065 gram ($\frac{1}{4}$ to 1 gr.)

Compound Cathartic Pills (*Pilulæ Catharticæ Compositæ*), dose, 1 to 3 pills.

Vegetable Cathartic Pills (*Pilulæ Catharticæ Vegetabiles*), dose, 1 to 3 pills.

Gamboge (*Pilulæ Catharticæ Compositæ*), dose, 1 to 3 pills.

Podophyllum (*Resina Podophylli*), dose, 0.008 to 0.03 gram ($\frac{1}{8}$ to $\frac{1}{2}$ gr.)

Fluidextractum Podophylli, dose, 0.3 to 0.5 c.c. (5 to 8 mins.)

Jalap (*Pulvis Jalapæ Compositæ*, 35% Jalap), dose, 1 to 2 grams (15 to 30 grs.)

Elaterin (*Elaterinum*), dose, 0.002 to 0.0065 gram ($\frac{1}{30}$ to $\frac{1}{10}$ gr.)

d. Saline Purgatives (produce copious, watery stools and give rise to but slight irritation).

Epsom Salt (Magnesii Sulphas), dose, 4 to 30 grams (1 to 8 drs.)

Glauber's Salt (Sodii Sulphas), dose, 8 to 30 grams (2 to 8 drs.)

Rochelle Salt (Potassii et Sodii Tartras), dose, 4 to 16 grams (1 to 4 drs.)

Sodium Phosphate (Sodii Phosphas), dose, for adult, 2 to 16 grams ($\frac{1}{2}$ to 4 drs.)

Magnesium Citrate (Liquor Magnesii Citratis), dose, 180 to 360 c.c. (6 to 12 fl. ozs.)

XII. Alteratives

Arsenic

Source: A metal that occurs in combination with many minerals. See also arsphenamine and neo-arsphenamine under Internal Antiseptics, p. 61. Arsenic is used in diseases characterized by cachexia, anemia, wasting, malnutrition, etc. The pathology of these diseases is often unknown and the nature of the action of the drug is still more obscure. It is given in the belief that it will tone up the system, increase the appetite, counteract the anemia and improve the general nutrition. Often the drug does appear to cause considerable improvement. It is frequently given with iron. Various forms of Arsenic have been used widely in protozoal diseases, such as Trypanosomiasis (Sleeping Sickness), Syphilis, etc. In Pernicious Anemia it often produces temporary

improvement. Many forms of skin diseases are treated with Arsenic, often with excellent results.

Preparation and Dosage:

Fowler's Solution (*Liquor Potassii Arsenitis*) contains 1% of Arsenous Acid neutralized with Bicarbonate of Potash, and is colored and flavored by addition of Compound Tincture of Lavender. Dose, 0.05 to 0.5 c.c. (1 to 8 mins.), or 3 to 5 drops three times daily, after meals.

Liquor Sodii Arsenatis, 1% of Sodium Arsenate, dose, 0.05 to 0.5 c.c. (1 to 8 mins.)

Donovan's Solution (*Liquor Arseni et Hydrargyri Iodidi*), 1% of Arsenic Iodide and 1% of Red Mercuric Iodide. Clear, yellowish solution, harsh, metallic taste. Dose, 0.05 to 0.5 c.c. (1 to 8 mins.)

Symptoms of Overdosage:

Itching and puffiness of the eyelids, nausea and diarrhea, skin eruptions, a feeling of constriction in the throat, etc. Large doses produce severe gastrointestinal irritation, pain in the abdomen, collapse, weakness, cramps in the muscles and limbs, profuse watery (rice water) stools, later containing blood and mucus. The symptoms closely resemble those of cholera.

Antidote and Treatment:

Lavage and emetics. The well-known "Arsenic Antidote" (*Ferri Hydroxidum cum Magnesii Oxido*) should always be kept on hand in hospitals and drug stores. The dose of this is 120 c.c. (4 ozs.). Lavage should be continued for some time. Magnesia alone may be given, or eggs, milk, etc. But the

main reliance should be placed in thorough, repeated washing out of the stomach. Stimulants (Caffeine, Digitalis), warmth, etc., should be administered. In chronic poisoning a peripheral neuritis may result in paralysis of certain groups of muscles. These may be treated by the galvanic current, massage, etc.

Iron (Ferrum)

General Tonic and Stomachic. Increases the appetite and tends to aid in the formation of new hemoglobin, in building up the blood in anemia. It is most frequently used in the treatment of chlorosis. Cases of pernicious anemia may show some temporary improvement under Iron. Cases of general malnutrition, cachexia, anemia and wasting such as are often found in chronic diseases are often helped by Iron. It is also used as an astringent and a styptic. This depends on its power to coagulate albumen.

Preparation and Dosage:

Tincture of Ferric Chloride, dose, 0.5 c.c. (8 mins.)

Reduced Iron (Ferrum Reductum), dose, 0.05 to 0.3 gram (1 to 5 grs.)

Blaud's Pills (Pilulæ Ferri Carbonatis), dose, 2 pills.

Syrup of Iron, Quinine and Strychnine Phosphate, dose, 2 to 4 c.c. ($\frac{1}{2}$ to 1 fldr.)

Syrup of Ferrous Iodide, dose, 1 c.c. (15 mins.)

Basham's Mixture (Liquor Ferri et Ammonii Acetatis), dose, 16 c.c. (4 fldrs.)

Most iron preparations produce constipation and cathartics have often to be taken with them. The

stools may be dark-colored from the formation of iron sulphide in the intestine. Many Protein Compounds of Iron have been put on the market, as the Albuminate or Peptonate, etc. On the whole these new compounds can scarcely be considered as superior to the older preparations and may often be inferior.

Iodides

Derived from Iodine, a non-metallic element found in seaweeds, some fresh-water plants, also in sponge, oysters, eggs, rock salt and several ores. Iodides are widely used in the treatment of tertiary syphilis. Other conditions, such as arteriosclerosis, aneurism, some forms of goitre, obesity, some skin eruptions, lymphatic enlargements, high blood pressure, some forms of cough, etc., have been treated with Iodides; but the results are usually doubtful, and in no case is it possible to tell how the drug acts in a given condition unless the patient be suffering from some (perhaps obscure) form of syphilitic lesion. Iodides are usually contraindicated in pulmonary tuberculosis because they may excite the lesion to renewed activity. Iodides are also used in the treatment of actinomycosis.

Large quantities of Iodides may cause a form of chronic poisoning known as Iodism. The symptoms of this are catarrh, redness, swelling and discomfort of the mucosa of the nose, throat, pharynx, larynx, etc. There is a profuse watery secretion, with much sneezing. The conjunctiva and frontal sinuses often

become involved. There may be marked salivation and involvement of the tonsils and possibly nausea and gastric discomfort. Skin eruptions of various forms often appear. It has been claimed that small doses are more liable to cause these skin lesions than large ones.

Preparation and Dosage:

Potassium Iodide ("KI"), dose, 0.1 to 1.3 grams (2 to 20 grs.). This is usually given in a saturated aqueous solution in gradually increasing doses up to the limit of tolerance.

Sodium Iodide (NaI), dose, 0.1 to 1.3 grams (2 to 20 grs.)

Iodoform, antiseptic dusting powder, often impregnated into antiseptic gauze dressings, slowly soluble in the tissue fluids.

Aristol (Thymol Iodide). A substitute for Iodoform.

Acidum Hydriodicum Dilutum, 10%, dose, 0.5 c.c. (8 mins.)

Iodine itself, in the form of the tincture (7%), is generally used as a local caustic or antiseptic, especially for the skin in surgical operations.

Lugol's Solution (Liquor Iodi Compositus) contains 5% Iodine dissolved in 10% Potassium Iodide solution. Dose, 0.2 c.c. (3 mins.)

XIII. Emetics

Apomorphine stimulates the vomiting center in the medulla. In large doses (therapeutic) it causes

prompt emesis if the center has not been too much depressed, as by Chloral, Chloroform, etc. By small doses, only the secondary symptoms of vomiting are produced without actual emesis. These lead to an increase of certain of the secretions, which action has been utilized in some respiratory troubles to increase and thin the secretions from the respiratory passages. These conditions are often better remedied by Ipecac or Antimony, which act for a longer time than Apomorphine.

Dosage:

Apomorphine Hydrochloride, 3 to 6 milligrams ($\frac{1}{20}$ to $\frac{1}{10}$ gr.)

Ipecac. See under Diuretics and Diaphoretics, p. 58.

Has been used extensively as an emetic, which action appears to depend on a local irritation of the sensory nerve endings in the gastric mucosa. Small quantities are also frequently used in expectorant mixtures. Other uses and dosage have already been given. See p. 59.

Tartar Emetic (Antimony and Potassium Tartrate)

Occasionally used as an emetic. It also has a limited use in expectorant mixtures. It has been used rather extensively in the treatment of Trypanosomiasis (Sleeping Sickness), being given either by mouth, intravenously or hypodermically. When given by the latter method, however, it is very prone to cause abscess formation.

Dosage:

Tartar Emetic (Antimonii et Potassii Tartras) as a diaphoretic, dose, 0.002 to 0.008 gram ($\frac{1}{30}$ to $\frac{1}{8}$ gr.); as an emetic, 0.03 to 0.1 gram ($\frac{1}{2}$ to 2 grs.)

Tartar Emetic, also contained in the Compound Syrup of Squill, is often used in the treatment of cough.

Ammonium Carbonate, Copper Sulphate, Mustard, Sodium Chloride (salt) and Zinc Sulphate. These substances cause vomiting by reason of the reflexes set up from their local irritant action on the mucous membrane of the stomach.

Preparation and Dosage:

Copper Sulphate, Blue Stone (Cupri Sulphas), dose, as an emetic, 0.3 to 0.6 gram (5 to 10 grs.). This should be given in 1% aqueous solution. This is also the chemical antidote for phosphorus poisoning, for the copper is deposited on the particles of phosphorus and prevents their absorption. Copper sulphate is also used as an astringent in gonorrhea, on ulcers, in the treatment of certain eye diseases, etc.

Ammonium Carbonate. See also under Respiratory Stimulants, p. 52. Ammonium Carbonate is used as an emetic in the dose of 2 grams (30 grs.)

Mustard. Mustard and warm water is often a convenient emetic in case of poisoning, dose, 1 dram+.

Sodium Chloride (salt), dose, a teaspoonful or more in half a glass of warm water.

Zinc Sulphate, dose, 0.6 to 2 grams (10 to 30 grs.)

XIV. Hematinics

Iron. Regularly given in certain forms of anemia. It is believed to assist directly in the formation of new hemoglobin, which contains iron. For preparation and dosage, see under Alteratives, p. 68.

Arsenic. This element does not enter into the composition of normal blood (as does iron), but on account of its beneficial action on the nutritive processes of the body it is frequently given in anemic or cachectic conditions. For preparation and dosage, see under Alteratives, p. 66.

XV. Intestinal Antiseptics, Anthelmintics

Salol (Phenyl Salicylate). Decomposes in the alkaline contents of the intestine, liberating Carboic Acid (Phenol) and Salicylic Acid. It has been claimed to lessen intestinal putrefaction. Dose, 0.3 to 1 gram (5 to 15 grs.)

Betanaphthol, dose, 0.25 gram (4 grs.)

Guaiacol Carbonate, dose, 0.2 to 0.5 gram (3 to 8 grs.)
Also given in pulmonary tuberculosis.

Calomel. See under Diuretics and Diaphoretics, p. 56.

Thymol, used extensively in the treatment of Anchylostomiasis or Uncinaria (hookworm). Given in emulsion or capsules. Dose, 2 grams (30 grs.). Repeated in two hours and followed six and eight hours later by a brisk saline purge.

Quassia. An infusion (10%) of Quassia is used as an enema for pin worms in children.

Santonin. Used as a remedy against *Ascaris Lumbricoides* (Roundworms). Dose (*Trochisci Santonini*), 0.03 gram ($\frac{1}{2}$ gr.). A purge should be given before the Santonin and again two to four hours after to remove the benumbed parasites.

Aspidium (Male Fern). This drug is effective against tapeworms and the *Anchylostomum Duodenale*. Dose, *Oleoresina Aspidii*, 2 c.c. (30 grs.). A light diet for one or two days followed by a purge should precede the administration of the drug. A second purge should be given six to twelve hours after the drug. Castor oil or other oily substances should not be taken near the time the drug is given, as these tend to dissolve the poison and to promote its absorption.

Granatum (Pomegranate Bark), used especially against tapeworms. Dose, *Fluidextract of Granatum*, 2 c.c. (30 mins.)

Pelletierine Tannate, dose, 0.25 gram (4 grs.). A decoction (1 to 2 ozs. bark in 250 c.c. water) is taken in two parts at an interval of one hour. The bowels should be emptied before and again one or two hours after the drug by a brisk purge.

Pepo (Pumpkin Seeds), dose, 60 to 120 grams (2 to 4 ozs.) of the powdered seed, given in emulsion or sugar or honey. A purge should be given afterwards.

XVI. Intestinal Astringents

Tannic Acid, Iron Salts, Alum

The astringent action of these bodies is due to their power to precipitate albumins and other proteins. A number of proprietary compounds containing Tannic Acid have been put on the market in recent years. Among these are Albutannin (Tannic Acid and Albumen), Protan (Tannic Acid and Casein), etc.

Preparation and Dosage:

Tannic Acid, dose, 0.1 to 0.6 gram (2 to 10 grs.)

Albutannin, dose, 0.5 to 2 grams (10 to 30 grs.)

Ferrous Sulphate, dose, 0.05 to 0.3 gram (1 to 5 grs.)

Alum (Alumen, Potassium Aluminum Sulphate), dose, 0.3 to 1 gram (5 to 15 grs.)

Bismuth acts chiefly as a protective powder in the alimentary canal, though it has some astringent properties. Bismuth salts are often given in considerable quantity in making X-ray examinations.

Preparation and Dosage:

Bismuth Subnitrate, dose, 0.3 to 2 grams (5 to 30 grs.)

Bismuth Subcarbonate, dose, 0.3 to 2 grams (5 to 30 grs.)

Bismuth Subgallate, dose, 0.25 gram (4 grs.)

Opium is often given to allay the peristaltic movements of the intestines.

See **Opium**, under Alkaloidal Narcotics and Hypnotics, p. 44.

Crude Opium is best for this purpose, as it is absorbed much more slowly than the pure salts.

Opium, dose, 0.1 gram ($1\frac{1}{2}$ grs.)

Powdered Opium (Opii Pulvis, 10% Morphine), dose, 0.02 to 0.1 gram ($\frac{1}{3}$ to $1\frac{1}{2}$ grs.)

Deodorized Opium (Opium Deodoratum), dose, 0.02 to 0.1 gram ($\frac{1}{3}$ to $1\frac{1}{2}$ grs.)

XVII. Antispasmodics

These are drugs which are believed to lessen states of nervous irritability and hysteria.

Valerian. Fluidextract of Valerian, dose, 2 to 4 c.c. ($\frac{1}{2}$ to 1 flr.)

Tincture of Valerian, dose, 4 c.c. (1 flr.)

Asafetida. Emulsion of Asafetida, dose, 15 to 30 c.c. ($\frac{1}{2}$ to 1 oz.)

Tincture of Asafetida, dose, 1 to 2 c.c. (15 to 30 mins.)

XVIII. Acidifiers

Dilute acids, as vinegar, etc., are used in the treatment of poisoning by alkalies.

Dilute Hydrochloric Acid is sometimes prescribed when the natural acid of the gastric juice is deficient or absent.

Dilute Acetic Acid (6%), dose, 1 c.c. and upward.

Vinegar (Acetum) is an impure dilute Acetic Acid.

Hydrochloric or Muriatic Acid (Acidum Hydrochloricum) is generally used as Acidum Hydrochloricum Dilutum, 10%. Dose, 1 c.c. (15 mins.), largely diluted.

Dilute Hydriodic Acid (Acidum Hydriodicum Dilutum), 10%, dose, 1 c.c. (15 mins.)

Dilute Hydrocyanic Acid (Acidum Hydrocyanicum Dilutum), 2%, dose, 0.1 c.c. (1½ mins.)

Hydrocyanic Acid and its salts (cyanides) are very rapid and active poisons.

Nitric Acid, Aqua Fortis (Acidum Nitricum), 68% HNO_3 . Sometimes used as a caustic to remove warts, etc.

Sulphuric Acid (Acidum Sulphuricum and Acidum Sulphuricum Dilutum, 10%).

Tannic Acid, Tannin (Acidum Tannicum), light greenish yellow crusts or powder, soluble in less than its weight of water or alcohol, in three parts of glycerin. Tannic Acid is largely employed in cases of poisoning because it forms insoluble precipitates with a large variety of different poisons.

As a rule in these cases the stomach should be thoroughly washed out after giving the Tannic Acid.

Trichloracetic Acid (Acidum Trichloraceticum), 10% watery solution, is used in skin diseases and to remove warts, etc.

Oxalic Acid is a dangerous poison.

XIX. Alkalinizers (Antacids)

Dilute alkalis are used as antidotes in poisoning with acids. In Hyperchlorhydria, Sodium Bicarbonate is often prescribed to relieve the pain (heartburn) by neutralizing the excess of Hydrochloric Acid. Alkali carbonates and bicarbonates and the Sodium

or Potassium salts of Acetic or Citric Acid are often used to render the urine alkaline. Lime Water (Liquor Calcis, Aqua Calcis) containing 0.17% of Calcium Hydroxide at 15° C. Dose, 16 c.c. (4 fldrs.) Potassium Hydroxide, 5%. Dose, 1 c.c. (15 mins.), largely diluted; rarely used internally.

Sodium Hydroxide, 5%. Use, chemical reagent.

Ammonia Water (Aqua Ammoniae, 10% NH_3) and stronger ammonia water (Aqua Ammoniae Fortior, 28% NH_3) may also be listed here.

The salts of the alkalis and alkaline earths (Ammonium, Potassium, Sodium, Lithium, Magnesium, Calcium, etc.), especially the Carbonates, Bicarbonates, Borates, Acetates, Citrates and Tartrates, may be mentioned.

Cerium Oxalate (1 to 8 grs.) is used as a gastric sedative.

Lead Acetate (1 to 2 grs.) has a limited use as an intestinal astringent and in a few preparations for local application.

XX. Local Anesthetics

Some substances when applied in solution locally, either by merely bathing mucous membranes or by injecting under the epidermis or mucosa, or into the tissues so as to reach sensory nerves, will produce a loss or impairment of certain sensations, especially those of pain. Other sensations, as touch, heat or cold, smell, taste, etc., may be more or less depressed or completely abolished, depending on the drug, its concentration and the method of application. If the

drug be injected into a nerve trunk supplying a certain part of the body, as an arm or leg, then sensation (usually mainly pain) may be lost throughout the whole extent of the limb below the injection. This is known as **Regional Anesthesia**. If the drug be injected into the spinal canal, then sensation may be lost throughout all that portion of the body below the injection and often for some distance above. This is known as **Spinal Anesthesia**. Cocaine and its derivatives are the best known local anesthetics.

Cocaine (Cocaina), an alkaloid derived from the leaves of *Erythroxylon*, a tropical plant.

Colorless crystals, with a bitter taste followed by numbness. Soluble in alcohol but not in water. The medicinal uses of cocaine are almost entirely dependent on its local anesthetic action. It also has a local styptic action. See under *Arteriole Constrictors*, p. 38.

Preparation and Dosage:

Cocaine Hydrochloride, colorless crystals, very soluble in water and alcohol. Watery solutions must not be sterilized by boiling, as the alkaloid tends to decompose. A small amount of Adrenalin is often added to Cocaine solutions to cause a greater local vasoconstriction and thus delay the general absorption of the Cocaine. This also enhances the local anesthetic action by keeping the Cocaine longer in contact with the tissues. A 4% solution of Cocaine Hydrochloride applied to a mucous membrane will cause complete anesthesia, but a 1% or 2% solution may allay pain.

In the nose and throat, solutions varying from 4% to 10% or even 20% are used.

Unpleasant side effects frequently met when Cocaine is used as a local anesthetic are palpitation, faintness, nausea and vomiting, and headache.

In **Infiltration Anesthesia** a large quantity (perhaps 200 c.c.) of 0.8% salt solution, containing 0.01% of Cocaine, is allowed through a fine hypodermic needle to permeate the tissues of the region to be operated on. Much of this solution escapes through the incisions, and general poisoning is not liable to occur.

In **Spinal Anesthesia** a lumbar puncture is made and 1 or 2 c.c. of spinal fluid withdrawn. Then 1 c.c. of a 2% solution (0.02 gram, $\frac{1}{3}$ gr.) of Cocaine Hydrochloride in aqueous solution is injected.

A considerable number of substances possess local anesthetic properties and several have been used as substitutes for Cocaine.

Procaine, of which Novocaine is one preparation, is similar in local action to Cocaine but less toxic. Others that may be mentioned are Eucaine or Beta-Eucaine, Alypin, Benzyl Alcohol, Holocaine Hydrochloride, Stovaine, Chloretone, Orthoform, Benzocaine (Anesthesin), etc.

Menthol and Phenol also cause loss of sensation when locally applied. Menthol also produces a sensation of cold. A spray of Ethyl Chloride and also of Ether produces local anesthesia by freezing the tissues. This is due to the cold produced by the sudden evaporation of the solutions.

ANTIDOTES AND TREATMENT FOR POISONING BY

Acetanilid. Symptoms: Collapse, cyanosis, slow respiration, feeble, irregular pulse, vomiting, sweating, etc. Treatment: Caffeine, heat, Strychnine, Digitalis, oxygen inhalations or artificial respiration. Atropine may be given in small doses to stimulate the respiration. Aromatic Spirits of Ammonia. The stomach may be washed out if necessary.

Acid, Acetic. Symptoms: Gastrointestinal irritation and collapse.

Treatment: Magnesia, soap and water, lime water, chalk, milk, oils and thick gruel.

Acid, Carbolic. (Phenol.) Symptoms: Collapse, cold, clammy skin, burning from mouth to stomach, nervous tremors, excitement or convulsions, smoky or dark, greenish urine, slow respiration, weak, feeble pulse.

Treatment: Lavage with 10% Alcohol at once. Epsom Salts, soapsuds, heat, Caffeine, Atropine, Aromatic Spirits of Ammonia, Strychnine, Digitalis.

Acid, Hydrocyanic (Prussic), also **Cyanides**, as **Potassium Cyanide**, **Sodium Cyanide**, etc.

Symptoms: Excitement, tremors, convulsions, dilated pupils, weakness, prostration, collapse, cold, clammy skin; slow, shallow, convulsive respirations (or Cheyne-Stokes type), feeble pulse, etc. Death from respiratory and cardiac failure in a few seconds after

a large dose of the acid. The salts act somewhat more slowly. Sodium Hyposulphate may be given intravenously.

Treatment: Artificial respiration, Ammonia inhalations, Caffeine, brandy, etc. Lavage of the stomach may be advisable if cyanides (KCN, etc.) have been taken. Recovery or death usually occurs quickly.

Acid, Oxalic. Symptoms: Gastrointestinal irritations, convulsions, collapse. Death from respiratory paralysis.

Treatment: Lime water, chalk, whiting, wall plaster in water, Magnesia, mucilaginous drinks.

Acids, Mineral (Hydrochloric, Nitric, Sulphuric, etc.)

Symptoms: Gastrointestinal irritation and collapse, pain in mouth, throat and stomach.

Treatment: Alkalies, as Magnesia, chalk, soap, whiting, wall plaster in water, albumen, flour, milk, starch, olive oil. Carbonates and Bicarbonates should be avoided, if possible. Avoid water in Sulphuric Acid cases. Warmth, Opium for the pain, Caffeine and general stimulants.

Aconite. See under Heart Depressants, p. 35.

Alcohol. Treatment: Emetics or lavage, cold affusion to the head, warmth to the extremities and trunk, artificial respiration. Drugs: Caffeine, Strychnine, Camphor, Atropine.

Alkalies. Symptoms: Gastrointestinal irritation, corrosion of mouth, throat and stomach.

Treatment: Diluted vegetable acids, as vinegar, lemon juice, etc., milk, gelatin, oils, Caffeine, Aromatic Spirits of Ammonia and other stimulants.

Ammonia. See **Alkalies.**

Amyl Nitrite and other nitrites (including Nitroglycerin).

Symptoms: Fullness and throbbing in the head, flushing, dilated pupils, deep, labored respiration, anxiety and restlessness. More severe symptoms are grave depression, cold extremities, collapse, etc.; persistent headache, possible convulsions and death from respiratory paralysis. Methemoglobin is formed in the blood. The blood pressure is very low.

Treatment: Caffeine, Strychnine, Ammonia, Atropine, artificial respiration.

Anesthetics (Ether, Chloroform, etc.)

Treatment: Artificial respiration. Adrenalin intravenously in small doses. Oxygen, Caffeine, Atropine, Strychnine, Ammonia. Keep up body warmth. Lower patient's head, draw tongue well forward intermittently to stimulate respiration. Electrical stimulation, hypodermic injection of camphorated oil, brandy, ether, etc., to stimulate respiration reflexly from the local irritation. The insertion of a rectal speculum may start up the respiration.

Antimony (Tartar emetic). Give Tannic Acid.

Antipyrine. See **Acetanilid.**

Atropine and Belladonna. See under Respiratory Stimulants, p. 51.

Chloral. See under Anesthetics. Wash out the stomach. Coffee. Enemata. External heat. Artificial respiration. Cardiac stimulants.

Cocaine. Symptoms of acute poisoning: Nervousness, restlessness, excitement, convulsions, faintness, weakness, pallor, cardiac and respiratory depression. See p. 79.

Treatment: Evacuate stomach if drug has been taken by mouth. Tannic Acid may be given. Amyl Nitrite has been advised for the high blood pressure and a few whiffs of chloroform or ether for the convulsions. Caffeine and Aromatic Spirits of Ammonia may be of use in the later stages.

Colchicum. Give emetics or lavage of the stomach. Tannic Acid may be given to precipitate the poison. External warmth, Caffeine, Strychnine and general stimulants may be used.

Digitalis (Digitoxin, etc.) See under Heart Stimulants, Digitalis, p. 31.

Mercury (Bichloride, etc., Corrosive Sublimate). Acute symptoms: Gastrointestinal irritation, with great pain, vomiting and diarrhea, collapse.

Treatment: Egg albumen (1 egg for each 4 grains of the poison), demulcents, milk and gastric lavage. Later, saline diuretics, rectal irrigation and repeated lavage of the stomach.

Opium, Morphine, Codeine, Heroine, Laudanum, Paregoric, etc. See under Narcotics and Hypnotics, p. 46.

Phenacetin. See Acetanilid.

Formaldehyde. Ammonia (well diluted) or ammonium salts is the chemic antidote, forming Urotropin. These should be followed by demulcents, such as bland oils, milk, white of eggs, starch water, etc.

Fish Poison (Ptomaine). Emetics, cathartics, enemata, etc.

Illuminating Gas. Treatment: Oxygen, artificial respiration, Ammonia vapor, Caffeine, black coffee enemata, horizontal position with clothing adjusted so as not to interfere with the respiratory movements, external heat, stimulation, catheterization.

Iodine. Symptoms: Gastrointestinal irritation, colored vomitus.

Treatment: Starch water with lavage, flour, gelatine, albumen.

Lead. Acute Symptoms: Vomiting, colic and collapse. Treatment: Emetics, lavage, Magnesium Sulphate, external heat and general stimulants.

Silver Nitrate. Symptoms: Gastrointestinal irritation. Antidote: Common salt (sodium chloride), albumen, milk, etc.

Phosphorus. Acute Symptoms: Vomiting, abdominal pain, collapse. Vomitus may be luminous in the dark.

Treatment: Emetics, and lavage with Potassium Permanganate (1:6000), saline purges, enemata. Avoid all oily or fatty substances, such as olive or castor oil.

Strychnine and Nux Vomica. See under Respiratory Stimulants, p. 50.

Veratrine. See under Heart Depressants, p. 37.

THE HARRISON NARCOTIC LAW

This law is a revenue measure, but it also serves the purpose of controlling and restricting the traffic in narcotic drugs. The revenue is derived in part from the registration fees of those who, under five classes, may lawfully deal in narcotic drugs, and in part from the sale of revenue stamps for the packages of the drugs themselves.

Nurses are not permitted to register, nor to be in possession of narcotic drugs or preparations except as consumers or agents. As consumers, nurses are of course subject to the same limitations in the issuance of narcotics as any other consumer. However, nurses are regarded as agents or employees of the registered physicians or institutions under whose direction or supervision their duties are performed, and as such agents, and while acting within the scope of such employment, they may be in temporary possession of narcotic drugs and administer them to patients according to the practitioner's orders. But any unused drugs left by a practitioner with a nurse to be administered during his absence must, upon discharge of the nurse, be returned to the practitioner, who will account for the drugs on his records. Any such narcotic drugs found in the possession of a nurse not at the time under the supervision of a practitioner shall be forfeited to the government.

Records. All practitioners, hospitals, etc., giving treatment in which a narcotic drug is necessary, are required to keep a daily record showing the kind and quantity of narcotic drugs or preparations dispensed or administered,

the name and address of each person to whom dispensed or administered, the name and address of the person upon whose authority, and the purposes for which it is dispensed or administered. No special record forms will be furnished by the government for this purpose, but such records as are kept must enable an inspecting officer quickly to ascertain the quantity and kind of narcotic drugs and preparations used daily. Only such narcotic drugs and preparations as are personally administered by a practitioner when in attendance upon a patient away from his office are exempt from such record. Narcotic drugs or preparations left with a nurse in charge of a patient, to be taken in the absence of the practitioner, must be recorded. Oculists, aurists, etc., who administer in their office practice minute quantities of narcotics in the form of solutions, need keep only a record of the date when a stock solution is made or purchased and the date when such stock solution is exhausted.

The drugs that come under the jurisdiction of this law include **Opium** and its derivatives, such as **Morphine**, **Heroine**, **Codeine**, **Dionine**, and their various preparations, also **Cocaine** and its various preparations. Dilute preparations of the narcotics containing other active drugs are exempt under certain specifications, particularly if for external application only. For instance, Camphorated Tincture of Opium (Paregoric) is exempt, having just less than the specified two grains of opium to the fluid-ounce.

NOTE. — The above statements on the Harrison Narcotic Law are based upon interpretative regulations found in an official pamphlet, "Regulations No. 35," relating to the handling of Narcotics, revised November, 1919, and published by the Government Printing Office for the Commissioner of Internal Revenue, United States Treasury Department. For further information, that pamphlet should be consulted.

PART IV
COMMON FORMULÆ

A. B. C. Diuretic (Mistura Diuretica)

A half-an-ounce dose contains
Potassium Acetate, gr.viiss
Potassium Bicarbonate, gr.viiss
Potassium Citrate, gr.viiss

A. B. & S. Pills

Aloin, gr. $\frac{1}{6}$
Extract of Belladonna, gr. $\frac{1}{8}$
Strychnine, gr. $\frac{1}{120}$

Aromatic Spirit of Ammonia

Ammonium Carbonate, 3.4%
Ammonia Water, 9%
Oils of lemon, lavender and myristica
Alcohol, about 68%
Water

Alum Acetate Liquor

Aluminum Sulphate, Glacial Acetic Acid, Calcium
Carbonate and Distilled Water

Basham's Mixture (See under Iron, Liquor Ferri et
Ammonii Acetatis), p. 68.

One dram contains approximately
Tincture Ferric Chloride, m.iiss
Dilute Acetic Acid, m.iiiss
Liquor Ammonium Acetate, m.xxx
Aromatic Elixir, m.vii
Glycerin, m.vii

Water, m.x

Dose, dr.ii+

Blaud's Pills (See under Iron, *Massa Ferri Carbonatis*),
p. 68.

Iron Sulphate, gr.iiss

Potassium Carbonate, gr.iiss

Brown Mixture (Compound Glycyrrhiza Mixture)

One ounce contains

Extract of Licorice, gr.xv

Acacia, gr.xv

Paregoric, dr.i

Wine of Antimony, m.xxx

Spts. of Nitrous Ether, m.xv

Water and Syrup

Dose, dr.i to oz.i

Compound Cathartic Pills (C. C. Pills)

One pill contains

Extract of Colocynth (Compound), gr. $1\frac{1}{4}$

Calomel, gr.i

Resin of Jalap, gr. $\frac{1}{2}$

Powdered Gamboge, gr. $\frac{1}{4}$

Compound Tincture of Benzoin

Benzoin, 10%

Aloes, 2%

Storax, 8%

Balsam of Tolu, 4%

Alcohol

Chloroform Liniment

Chloroform, 30 c.c. in soap liniment, 100 c.c.

Compound Licorice Powder

One dram contains

Powdered Sugar, gr.xxx

Oil of Fennel, m. $\frac{1}{4}$

Powdered Senna, gr.xss

Washed Sulphur, gr.v

Dose, dr.ss to ii

Dobell's Solution (Liquor Sodii Boratis Compositus)

Sodium Borate (Borax), dr.ii

Sodium Bicarbonate, dr.ii

Glycerin, dr.iv

Carbolic Acid, m.xx

Distilled Water, q. s. ad oz.xvi

Durandi's Solution

Iodine, gr.v

Potassium Iodide, gr.x

Guaiacol, gr. xxv

Glycerin, oz.i

Imperial Drink (Haustus "Cremor Tartari")

Potassium Bitartrate, 160 grains

Spirit of Lemons, 15 minims

Syrup, 3 $\frac{1}{2}$ ounces

Water, q. s. ad 32 ounces

Red Wash

Zinc Sulphate, 10 grains

Tincture of Lavender, 2 drams

Water, q. s. ad 4 ounces

Rhubarb and Soda Mixture (*Mistura Rhei et Sodæ*)

One dram contains

Sodium Bicarbonate, gr.ii

Fluidextract Rhubarb, m.ii

(Fluidextract Ipecac)

Glycerin, m.viii

Spirits of Peppermint, m.ii

Water, m.xlvi

Dose, dr.i+

Seidlitz Powders (*Compound Effervescing Powder*)

Sodium Bicarbonate, 45 grains and

Potassium-Sodium Tartrate (*Rochelle Salt*), 117
grains in each blue paper

Tartaric Acid, 34 grains in each white paper

Stokes' Expectorant

One dram dose contains

Ammonium Carbonate, gr.i

Fluidextract Senega, m.ii

Fluidextract Squill, m.ii

Paregoric, m.xi

Syrup of Tolu

Water

Thiersch's Solution (*Liquor Boro-Salicylicus*)

Salicylic Acid, gr.xv

Boric Acid, gr.xc

Water, q. s. ad oz.xvi

LATIN PHRASES AND ABBREVIATIONS

aa.	ana	of each
a. c.	ante cibum	before meals
ad	ad	to, up to
ad lib.	ad libitum	at pleasure
alb.	albus	white
alt.	alter	the other
alt. hor.	alternis horis	every other hour
alt. noc.	alterna nocte	every other night
aq.	aqua	water
aq. calc.	aqua calcis	lime water
aq. dest.	aqua destillata	distilled water
aq. pur.	aqua pura	pure water
b. i. d.	bis in die	twice a day
c.	cum	with
c. c.	centimeter cubicum	cubic centimeter
comp.	compositus	compound
dil.	dilutus	dilute
div. in p. æq.	dividatur in partes æquales	Let it be divided into equal parts
dr.	drachma	a dram (60 grains)
et	et	and
ext.	extractum	extract
F.		Fahrenheit
fl.	fluidus	fluid
fol.	folia	leaves
garg.	gargarisma	a gargle
gm.	gramma	a gram
gr.	granum	a grain

gtt.	gutta	a drop
h.	hora	hour
hor.	hora	hour
infus.	infusum	an infusion
inject.	injectio	an injection
K.	Kalium	Potassium
lac.	Lac, lactis	milk, of milk
lb.	libra	a pound
liq.	liquor	a solution
lot.	lotio	a lotion
M	Misce	mix
m.	minimum	a minim
min.	minimum	a minim
mist.	mistura	mixture
mol.	mollis	soft
nig.	niger	black
no.	numero	in number
noct.	nocte	at night
O.	octarius	a pint
ol.	oleum	an oil
o. h.	omni hora	every hour
o. m.	omni mane	every morning
o. n.	omni nocte	every night
os	os	the mouth
oz.	uncia	an ounce
p. r. n.	pro re nata	occasionally, as needed
p. c.	post cibum	after meals
per	per	through, by means of
per os		by mouth

per rectum		by rectum
pulv.	pulvis	powder
q. h.	quaqua hora	every hour
q. s.	quantum sufficit	as much as is sufficient
R.	recipe	take
rad.	radix	root
rub.	ruber	red
sem.	semen	seed
s. o. s.	si opus sit	if necessary
sp. gr.		specific gravity
s.	sine	without
ss.	semissis	a half
sol.	solutio	a solution
spt.	spiritus	a spirit
stat.	statim	immediately
s. f.	spiritus frumenti	whisky
s. v. r.	spiritus vini recti- ficatus	alcohol
s. v. g.	spiritus vini gallici	brandy
syr.	syrup	a syrup
t. i. d.	ter in die	thrice daily
tr.	tinctura	tincture
troch.	trochiscus	a lozenge
ung.	unguentum	an ointment
vin.	vinum	wine

REFERENCE BOOKS

U. S. P. = The United States Pharmacopœia, Ninth Decennial Revision. This is the book of American standards (purity, potency, etc.) of drugs and their preparations, and contains directions for their identification, as well as for the manufacture of the pharmaceutical preparations of the crude drugs. It is revised every ten years by a special committee from the United States Pharmaceutical Convention.

N. F. = The National Formulary. This is a book of standards of drugs and preparations popularly used, but not in the U. S. P. It is revised periodically by a committee from the American Pharmaceutical Association, and is owned by that association.

N. & N. R. = New and Non-official Remedies. This is a list compiled by the Council of Pharmacy and Chemistry of the American Medical Association, of such *proprietary* preparations as conform to the standards set by that council. It is revised and republished annually.

PART V

ANTITOXINS, VACCINES AND SERA

Toxins are specific poisons produced by bacterial growth in suitable media. When they enter the circulating blood from bacteria growing in or upon the tissues of the organism, they are the exciting cause of acute infectious diseases, such as Tetanus, Diphtheria, Cholera, Pneumonia, Erysipelas, Typhoid, etc.

Antitoxins are supposititious substances believed to be produced by the cells of the tissues for the defense of the organism against foreign bacterial toxins.

Antitoxic Sera are composed of blood serum containing antitoxin produced therein by the cells of the organism as a result of the repeated injection of a toxin into the tissues of the animal from which the serum is taken.

An Antitoxic Unit is generally recognized as the quantity of an antitoxic serum which will counteract a definite amount of toxin in a guinea pig.

Bacterial Vaccines are suspensions of killed bacteria in sterile salt solution. A preservative, as 0.5% Phenol, is usually added. Generally speaking, vaccines are composed either of the bacteria themselves unchanged (except in so far as they are affected by the heat used in killing them or by pulverization) or are some derivative of the bacterial cells. A large number of vaccines have been placed on the market. While some of these are of great importance, the value of many others is extremely doubtful.

The treatment by the toxic products of diseases due to pathogenic microbes is based upon the theory that germs produce in their culture media substances which, while poisonous to the animal body, may, on the other hand, stimulate the cells of the tissues to generate substances which are capable of neutralizing the toxins (*i. e.*, anti-toxins), or perhaps may lead to the death of the bacteria themselves (*i. e.*, bactericidal sera). By "culture media" is meant substances in which bacteria will grow, *e. g.*, agar, gelatin, bouillon, milk, etc.

In 1891 the following law was formulated by Behring: "The blood serum of an animal which has been artificially rendered immune against a certain infectious disease, when injected into the body of another animal, has power to protect the latter individual against the same disease and to cure the disease after infection has occurred."

The fact of spontaneous recovery from infectious disease indicates that the body has the power to immunize itself against the bacteria and the bacterial products which are its cause. This faith in such immunizing ability is shown in the present method employed in the treatment of pulmonary tuberculosis, of placing the patient under the best conditions of hygiene and trusting for the cure to the inherent power of the body.

The only real success in securing protection against diseases produced by microorganisms, and in the cure of them, is now known to be based upon the artificial direction of the body's own immunizing ability, by means of removing obstacles to its action, of furnishing appropriate stimulus when such is lacking (vaccines, etc.), or by the

addition to the blood stream of specific substances (antitoxins, immune sera, etc.) which the body itself produces, but not in sufficient quantity to be effective against the infection under which it is struggling.

In protection against **Typhoid**, for instance, the use of typhoid vaccine induces the protective mechanism to fortify the blood with elements which are calculated to destroy typhoid bacilli when they enter the body. Quite the same elements appear to be responsible for the recovery from the disease. A good example of success in following nature's lines of treatment in the cure of disease is that obtained in the treatment of **Diphtheria** by antitoxin. Here we furnish, at a time when the body may be lacking in ability to neutralize the toxin of diphtheria, a substance which is known to neutralize diphtheria poison and to render it inert. The remarkable reduction of mortality in diphtheria attests the efficacy of this measure. Not only has the mortality been reduced, but there has been an extraordinary decrease in the severity of symptoms. The prophylactic or immunizing dose in diphtheria is from 1000 to 1500 units. The diphtheria unit is the amount of antitoxin necessary to protect an animal against 100 times the fatal dose of toxin for a guinea pig weighing 250 grams.

Immunity is freedom from risk of infection. There are two kinds, Active and Passive.

Active Immunity may be caused by recovery from a natural attack of an infectious disease, or it may be caused by the use of a vaccine which may be composed of living cultures of pathogenic bacteria of diminished or altered

virulence, or of bacteria that have been killed by heat. An example of the use of living vaccine is **Vaccination**. For this method is used a culture of the **Smallpox** organism that has been modified by passage through calves by inoculation. By some authors this modified organism is believed to be entirely separate and distinct from the organism which caused human smallpox. Others, however, consider that this germ is identical with the smallpox organism, but that by passage through calves it has lost certain of its original characteristics. This modification is of such a nature that it has lost its power of producing the general disease, smallpox, but it has retained that of causing a local disease, vaccinia or cowpox, otherwise similar in nature. It appears here that through the stimulus which this mild disease furnishes, the cells of the body have derived an increased power to resist infection of smallpox. Here, then, has been made use of the body's own methods of protection against disease.

Another example of the production of active immunity by the use of a vaccine is the treatment for **Rabies** (Hydrophobia). The organism of this disease is unknown, but the virus or toxin occurs in the brain, and emulsions of this substance are used for inoculation. Rabbits are inoculated with this and their infected spinal cords are dried and used as a vaccine. This, in gradually increasing degrees of virulence, is given to patients. The virulence depends upon the time during which the drying has gone on, since drying after a time removes it.

Passive Immunity, or Antitoxic Immunity, is conferred in experimentation by injecting into a susceptible

animal the serum of one which has acquired an active immunity to the disease in question. Active immunity takes some time, but passive immunity is established as soon as the serum has become mixed with the blood of the person or animal injected. Hence in severe infections our best hope is in the production of passive immunity. Passive immunity is of brief duration, in general terms from three to six weeks.

All the Antitoxins cause passive immunity.

Anaphylaxis or Serum Sickness. If a small amount of a foreign proteid, as a serum, is injected into an animal and no further treatment is given for a period of about two weeks, it will be found that after that period a certain change has been produced in the tissues of the animal. This changed condition may last for a considerable time, often for several years. It consists in an increased susceptibility to the same proteid as that with which it was first injected. For if after two or three weeks a second injection (which may be very small) is given to the animal, a very marked, often alarming or even fatal series of symptoms may be produced. The nature and outcome of these symptoms vary considerably with different species of animals. In some, as the guinea pig, a bronchial spasm is produced which may lead to death from asphyxia. In other species, as the dog, there is produced a profound fall in blood pressure, vomiting, purging, dyspnea, general muscular weakness, etc.

In man the symptoms usually observed consist of exanthematous eruptions, fever, edema, general malaise, collapse, etc. These symptoms may be produced by the

injection of antitoxic sera or even normal serum (which is natural, or untreated, horse serum). They are due to the foreign proteid of the serum and not to the antitoxic element which it contains, for normal horse serum may cause it in a sensitized individual. Certain articles of food, as egg albumen, may act thus upon persons who have become sensitized to this form of proteid.

This increased susceptibility to foreign protein substances has been used as an aid in clinical diagnosis. Examples of this are found in the employment of tuberculin in the diagnosis of tuberculosis, ofluetin to diagnose syphilis, etc. Similar diagnostic procedures are now being employed for sufferers from Hay Fever, Asthma, Urticaria (Hives), etc., by testing the individual's susceptibility to the proteids of foods, plants, even of strains of bacteria, these proteids being applied in minute quantities to scratches in the skin.

Schick has introduced a test for the determination of the susceptibility of a person to an attack of diphtheria. It consists essentially in determining, by means of the skin reaction following the intracutaneous injection of a minute quantity of diphtheria toxin, whether or not there exists in the individual's tissues an amount of natural antitoxin sufficient to produce immunity against the disease. The immunity is shown by whether or not this natural antitoxin stops the toxin's causing the local reaction.

USES AND DOSAGE OF ANTITOXINS, VACCINES AND SERA

A very large number of sera and vaccines have been placed on the market. Only a few need be mentioned here. The methods by which these preparations are produced, the manner in which they are intended to be administered and the size of the dose vary greatly with different manufacturers. It is generally desirable to secure specific information about each preparation before it is used. Sera should not as a rule be used if they are more than one year old, and it is best to secure the freshest possible samples.

Antidiphtheritic Serum (Diphtheria Antitoxin). The serum of a horse immunized against diphtheria toxin, kept in the dark and at a low temperature in sealed glass tubes. Average dose, 5000 units; prophylactic dose, 1000 to 1500 units, protects only for about three weeks.

Antitetanic Serum (Tetanus Antitoxin). Immunizing dose, 1500 units; in tetanus, 3000 to 20000 units, repeated. Of great value as a prophylactic agent, and of some value in treatment of the disease.

Antimeningococcic Serum (Meningitis Antitoxin). A serum prepared from the blood of horses immunized to the meningococcus of Weichselbaum. Useful in the treatment of epidemic cerebrospinal meningitis. Dosage, varies with the manufacturer, usually 15 to 30 c.c. given intraspinally, and repeated.

Antigonococcic Serum (Gonorrhea Antitoxin). Serum prepared from the blood of rams or horses immunized against the gonococcus. Variable dosage.

Normal Horse Serum. Marketed in vials or syringes containing from 10 to 100 c.c. Sometimes used in the treatment of hemorrhage, hemophilia, etc. Calcium salts or gelatin, etc., may be given in addition, to increase coagulability.

Among the vaccines should be mentioned autogenous vaccines, stock vaccines, typhoid vaccine, smallpox vaccine and tuberculin.

Autogenous Vaccines. Prepared from cultures obtained from the individual to be treated. These usually give the best results. The dosage varies with each preparation, though usually 0.5 to 1.0 c.c., intramuscularly.

Stock Vaccines. A large number on the market, varying greatly in character and, as a rule, not used if autogenous vaccines are available. Stock vaccines may contain only one organism, or several organisms. These latter (mixed vaccines) are looked upon with especial disfavor. Bacterial vaccines are used to aid in the production of an active immunity and should be given only when bacteriologic examination has demonstrated the infecting organism. Clinical reports vary greatly in their estimation of the value of vaccines in many acute infections.

Typhoid Vaccine. Widely used in the last few years to produce immunity against typhoid. Its great effectiveness and value have been shown repeatedly among large bodies of soldiers. Probably protects two years or more.

Smallpox Vaccine. Vaccine virus is the material obtained from the skin eruptions of calves having vaccinia. Ground up, mixed with glycerin and sold in capillary

tubes or as glycerinated points. Clinically it is used to produce immunity against smallpox. The protection is thought to last seven years or more, but those exposed to smallpox who have not been successfully vaccinated within a year should be re-vaccinated.

Tuberculin. A large number of preparations on the market, but all practically identical in their physiological effects. There are two general classes of tuberculins: first, those prepared from the germ-free culture-media and containing for the most part only the soluble products of the bacilli (Koch's Old Tuberculin); second, those which contain the greater part of the germ body itself (Koch's New Tuberculin). These preparations vary chiefly in a quantitative way and in absorbability. They are used both for diagnostic and therapeutic purposes.

A few words should be said concerning the treatment of **rabies** or hydrophobia by the use of vaccines. There are several methods, but whatever the method the value of the process cannot be doubted. Active immunization appears necessary because of the long period of incubation (one week to six months or longer) and the localization of the virus in the nerves. After the bite of a rabid animal the probability of a patient's developing the disease depends upon the severity of the bite, its position (that is, whether or not in regions rich in nerves), and on whether the bite is through clothing so that some of the virus is wiped from the teeth. See p. 99.

The **Widal Reaction** for the diagnosis of typhoid fever and the **Wasserman Test** for the diagnosis of syphilis may be mentioned as further examples of the uses of sera.

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